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AN
Univerſal Military Dictionary,
Or,
A Copious Explanation of the Technical Terms &c Used in the Equipment, Machinery, Movements, and Military Operations of an Army.

By

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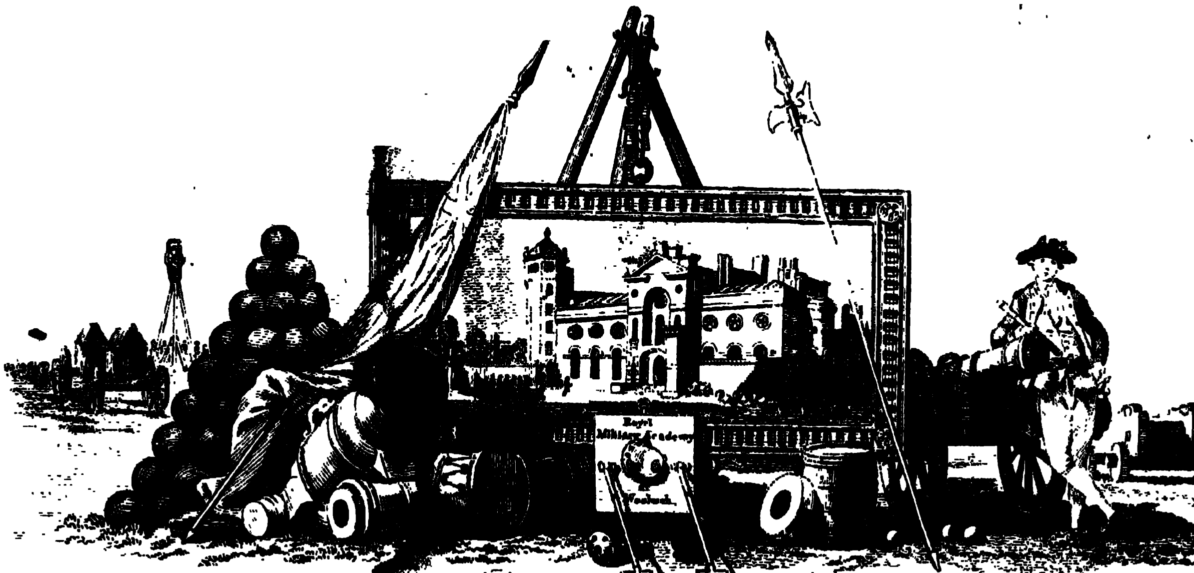

P. Sandby delin. C. Grignion sculp.

London.
Printed for J. MILLAN, near Whitehall; 1779.

TO THE

KING.

SIRE,

NOTHING can juſtify my preſumption in approaching your Royal Perſon with this Work, but the conſideration, that it is not foreign to the ſtation in which your Majeſty has vouchſafed to place me, and that it treats of an Art which conſtitutes one of your favorite amuſements.

Animated with the deſire of promoting, within my own ſphere, the intereſt and welfare of my Country, I have been emboldened to engage in the undertaking: And, perſuaded that your permiſſion to addreſs my Work to your Majeſty cannot fail to ſuggeſt to every Student in the Military Art, that ſuch a performance is eſſential to the attainment of that Art, I have cheriſhed the ambition of laying it at your Royal ſeat; hoping, that under the gracious favor and protection which your Majeſty deigns to extend to the well-meant endeavours of your Subjects, it will be conducive to the end for which it was undertaken.

That your Majeſty may long reign in the hearts of a brave, free, united, and happy People, is the ardent wiſh of

Your MAJESTY's

Moſt dutiful and moſt faithful

Subject and Servant,

George Smith.

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PREFACE.

IT being the general opinion, that the dignity of ſciences is more or leſs in proportion to their uſefulneſs, how apparently then does the Art of War claim the firſt place! War (as ſome ſay) is a great evil; but it is inevitable, and oftentimes neceſſary. If he who firſt reduced to rules the art of deſtroying his fellow-creatures, had no other end in view but to gratify the paſſions of Princes, he was a monſter, whom it would have been happy to have ſmothered at his birth! but if his intention was the defence of perſecuted Virtue, or the puniſhment of ſucceſsful wickedneſs, to curb Ambition, or to oppoſe the unjuſt claims of ſuperior Power, his memory ſhould be revered by mankind.

War, in the laſt caſe, is the moſt neceſſary and uſeful of all the ſciences. The various kinds of knowledge, which ſhould furniſh the mind of a Soldier, are not without great difficulty attained. Of moſt other ſciences the principles are fixed; or, at leaſt, they may be aſcertained by the aſſiſtance of experience: there needs nothing but diligence to learn them, or a particular turn of mind to practiſe them. Philoſophy, Mathematics, Architecture, and many others, are all founded upon invariable combinations. Every man, even of a narrow underſtanding, may remember rules, apply them properly, and ſometimes draw juſt conſequences from them: but the ſtudy of War is of another kind.

Experience can be ſo ſeldom referred to rules, that nothing but a mind enlightened by diligent ſtudy can make a due application of thoſe rules to circumſtances.

Moſt artiſts may join practice to theory, and make one perfect by the help of the other. The military man has not always the like aſſiſtance: he ſpends part of his life in forming plans, which humanity forbids his putting in execution; and when he has an opportunity of judging from experience of the ſolidity of his principles, the operations are ſo rapid, the motions ſo diverſified, the actions ſo confuſed, that he has ſcarcely time for a glimpſe of thoſe things which require the moſt calm and cloſe conſideration.

Of learning of every kind, theory is the completion; in the ſtudy of the military ſcience, it is only the introduction. Many an Officer, depending on his rules, has found that the marches, the camps, the diſpoſitions, the manœuvres, performed with exactneſs and ſtrict order in the cloſet, have not only been very difficult, but even impracticable, in the field. A diſpoſition good in a mountainous country, would be bad in an open one; a diſpoſition proper for one open country may fail in another, for want of its being foreſeen that a manœuvre, which in one caſe may have been the cauſe of obtaining a victory, may in another occaſion its loſs: the circumſtances of time and place almoſt always throw the beſt-conſtructed ſyſtems out of order. It is therefore only by ſtudy, and by the contemplation of caſes inceſſantly varied, that the want of practice can be ſupplied, or action at leaſt made leſs difficult.

A military man, who wiſhes to be maſter of his profeſſion, has no hours to loſe: in peace he ſhould ſtudy with the greateſt diligence; in war he will ſee his principles open themſelves of their own accord: his ideas are then more diſtinct; he acts with clearneſs and certainty in all caſes he has foreſeen, and applies his rules to all thoſe which now occur for the firſt time, and which 'till then had eſcaped his attention. Who does not know that bravery, courage, and comprehenſion, are uſeleſs and fatal to a military man who wants knowledge of his buſineſs? Having no previous aſſiſtance from ſtudy, it often happens, that the braver he is, the more he is liable to miſtakes, and the leſs able to foreſee or avoid them.

The ſcience of War branches out into ſo many particulars, it takes in ſo many different parts, there are ſo many reflections neceſſary to be made, ſo many circumſtances and caſes to be brought together, that it is only by a continual application, grounded upon the love of his duty, and an inclination to his profeſſion, that any man can attain it.

To march an army in every ſort of country, whether open, woody, or mountainous; to know how to form a camp in all theſe countries, with which the General muſt be thoroughly acquainted, in order to do it ſecurely; to make a proper diſpoſition for a battle, whether with a view to the poſture of the enemy, or to the ſituation of the country; to foreſee events which depend, in a manner, upon chance; to direct the foragers without fatiguing, or expoſing the troops; to ſend out detachments with precaution; to conduct the convoys with ſafety; to know how to canton an army, and to ſettle it in winter quarters, in ſuch a manner, that by the juſt diſpoſition of all the parts, it may be able to aſſemble readily on the firſt order, though widely diſperſed; to eſtabliſh magazines in places both ſafe and within reach of the army, ſo that it ſhall never be in want of ſubſiſtence: theſe are the great ends of the military ſcience. Alexander, Guſtavus, Weimar, Condé, Turenne, Montecuculi, Vendoſme, Marlborough, Eugene, Schwerin, Wolfe, and all the great men that have gone before, would never have been the ſubject of our admiration, if they had neglected this ſtudy in any of its branches. It is by courage, genius, and capacity; by having a head always cool, and an eye at once quick and exact; by a nice knowledge of the country, by ſkill in the choice of officers, and by ſtrict diſcipline kept up in his army, that a General is enabled to take ſuch juſt meaſures as will fruſtrate the deſigns of the enemy.

It is commonly thought ſufficient for a military man to know how to obey; and it is alſo ſuppoſed that the ſucceſs of a day cannot be dubious, if a General joins the confidence of the Soldiers to all the foregoing qualities.

It is true, that in caſes of perplexity, many Generals have in a great meaſure owed to their own capacity, and the confidence their Soldiers have repoſed in them, the advantage they have gained over the enemy. But is the Officer who loves his duty, and who would make himſelf maſter of it, under the leſs obligation to know what qualifications his ſtation requires? that he ſhould have ſuch or ſuch a quality, in ſuch or ſuch a circumſtance? that here only bravery is neceſſary, there only courage? and that he is not always obliged to have both at the ſame time?

Theſe two virtues, which are often confounded in the ſame ſubject, merit a particular diſtinction: they are not ſo cloſely united, but that they are often to be ſound one without the other. Courage ſeems fitteſt for a General, and all thoſe who command; bravery more neceſſary for a Soldier, and all who receive orders: bravery is in the blood, courage in the ſoul; the firſt is a kind of inſtinct, the ſecond a virtue; the one is an impulſe almoſt mechanical, the other a noble and ſublime conception. A man is brave at a particular time, and according to circumſtances; he has courage at all times, and upon all occaſions. Bravery is ſo much the more impetuous as it is leſs the reſult of reflection; courage, the more it is the effect of reaſon, becomes more intrepid. Bravery is inſpired by the force of example, inſenſible of danger, and the fury of action; courage is infuſed by the love of our duty, the deſire of glory, and zeal for our king and country: courage depends on reaſon; but bravery, on the conſtitution. Achilles, ſuch as Horace deſcribes him from Homer, implacable, cruel, deſpiſing every other right but that of force, preſents nothing to the idea, but the hardineſs of a gladiator: but the Roman General, whoſe death would have produced the ruin of the army, the great Scipio, when covered by the bucklers of three ſoldiers, to avoid a ſhower of arrows which the enemy directed againſt him, approaches in ſafety the walls he beſieged, and ſtanding only a ſpectator of the action, and content himſelf with giving them orders, exhibits the idea of true courage. Bravery is involuntary, and depends not at all upon ourſelves; whereas courage (as Seneca obſerves) may be taught and acquired by education: but yet, nature muſt ſow the firſt ſeeds of it. It would be eaſy to make the difference of theſe qualities better underſtood, by running over all the caſes in which they make their appearance, were it not for the fear of going too far in ſo copious a ſubject. It is ſaid of a magiſtrate, who expoſes his life and fortune in defence of the laws, that he has virtue. Cicero, ſheltering himſelf from the hatred of Catiline, undoubtedly wanted bravery; but certainly he had an elevated firmneſs of mind (which is in reality courage), when he diſcloſed the conſpiracy of that traitor to the Senate, and pointed out all his accomplices; or when he pleaded for Deiotarus againſt Cæſar, his friend and his judge.

Coolneſs is the effect of courage, which knows its danger, but makes no other uſe of that knowledge, than to give directions with greater certainty: courage is always maſter of itſelf, provided againſt all accidents, and regulated by the preſent occaſions; never confounded by any danger, ſo as to loſe ſight of the motions of the enemy, or of the means by which he may be moſt effectually oppoſed. At the battle of Cannæ, when Giſco ſeemed to be moſt aſtoniſhed at the ſuperiority of the enemy's number, Hannibal anſwered him coolly, "There is a thing ſtill more ſurpriſing, of which you ſeem to take no notice." Giſco aſked him what it was: "It is, replied Hannibal, that in all that great croud, there is not one man whoſe name is Giſco." Plutarch obſerves, that this coolneſs of Hannibal greatly animated the Carthaginians, who could not imagine that their General would joke at ſo important a time, without being certain of overcoming his enemies.

Although bravery and courage are the moſt eſſential qualifications of a ſubordinate officer, yet he ſhould not be deficient in thoſe which are required in a General, and which have been already mentioned: obedience to the orders delivered to him, is no longer a virtue than whilſt he comprehends and knows the intention of them. War, ſays a celebrated author, is a buſineſs which like all others muſt be learned; it ſuppoſes ſome qualities to be born with us, and demands others which are to be acquired: but ſince all theſe qualities muſt have their original ſource in genius, a man who propoſes war for his profeſſion, ſhould never engage in it without having conſulted his natural bent, or without knowing the particular turn or power of his mind. Ability, whether in a General, or inferior officer, is the effect of his genius, quickened by a natural liking to his buſineſs. Without this liking, without this ſort of call, which as it were draws us on againſt our wills, and which is the ſure ſign of a particular determination of the mind, a man ſtudies without effect, and practiſes without judgement.

Genius is not to be acquired; it is born with us. It has been defined to be a natural aptitude of doing ſomething: but that definition is wrong; it is the diſpoſition only that ſhould be ſo defined. It is ſaid to be eaſier for nature to produce a monſter, than a man without a particular diſpoſition: but every one is not born with a genius; it is the faireſt attribute of the ſoul. With parts a man may be a good ſoldier; but with genius a good ſoldier becomes a great general. It is ſometimes an aſſemblage of talents, but is always the perfection of that which nature has given us, that diſcovers genius. A man ſtudies; he ſearches for his talent, and often miſſes it; genius unfolds it. Talent remains hidden for want of occaſions to ſhow itſelf; Genius breaks through all obſtacles: Genius alone is the contriver; Talent, only the workman.

It often happens, that he who has only bright parts, is believed to have genius. Theſe two modifications of the ſoul are very different. Genius can only apply itſelf to the ſciences and noble arts; Wit, more airy, ſkims indifferently over all: the former undertakes but one ſcience, but goes to the bottom of it; the other would undertake every thing, but touches only lightly upon all: Wit renders the talents more brilliant, without their becoming more ſolid; Genius, with leſs application, conceives every thing, outſtrips even ſtudy itſelf, and brings the talents to perfection.

There are many amongſt us who become ſoldiers, only becauſe their anceſtors were ſo: they undoubtedly have bravery; that virtue is not ſcarce among the Engliſh; but there are many others which ſhould accompany it. The virtues of our anceſtors ſhould ſtimulate our minds, and engage us to follow their ſteps; but their blood, tranſmitted to us, does not always convey that ſagacity, that intelligence, that particular inclination for our buſineſs (the true mark of genius) in a word, thoſe talents of which we muſt carry the ſeed within us.

But ſome are by birth engaged in the profeſſion of arms, before time has permitted them to conſult their genius and their powers. Are theſe men to quit, if they perceive that they are not endowed with every talent that profeſſion requires? Undoubtedly no; becauſe they may acquire them. Study and application will in a great meaſure ſupply the defects of genius; docility may ſerve inſtead of talents; the love of glory be equivalent to a liking for their buſineſs; and the virtues of their fathers ſhould always be preſent to their thoughts. When a man has no anceſtors to imitate, he is (if I may uſe the expreſſion) at liberty to raiſe a reputation of more or leſs luſtre: by being deſcended from celebrated anceſtors, he is obliged to follow their example, and may often improve upon their virtues. Claudius reproached Cicero with being the firſt of his race. ‘But you,’ anſwered Cicero, ‘are the laſt of yours.’ An illuſtrious deſcent is oftentimes a burthen: if it adds ſplendor to the man of virtue, it always diſgraces him who knows not how to ſupport it.

A quick eye is natural in ſome, and in them it is the effect of genius; others acquire it by ſtudy or experience. He who knows how to command himſelf, and has courage enough to keep himſelf cool on the moſt urgent occaſions, has the readieſt and quickeſt eye. A quick, hot-headed man, however brave, ſees nothing; or, if he does, it is confuſedly, and generally too late. It is this quick eye which enables him to judge of an advantageous poſt, of a manœuvre to be made, and of a good diſpoſition for the troops, whether with reſpect to that of the enemy, or to the ſituation or nature of the country. There is a quickneſs of eye which depends upon the enemy, and another independent of him. It depends upon the enemy when he has made ſuch a diſpoſition, that to attack him another muſt be made upon the ſpot, which renders his defective and weak in ſome part; or when, being advantageouſly poſted, the General obliges him to change his poſition, by making him fearful of being taken in flank, or of being ſurrounded; or when it is ſo contrived as to render the troops on the right uſeleſs, by attacking the left, without their being able to aſſiſt it.

It is independent of the enemy, when a commander, being at a diſtance, knows how to take an advantageous poſition, and how to chuſe a camp ſtrong by ſituation; when he ſees at once what diſtances there are upon the right and left of the troops, that may prevent either their being moleſted or ſurrounded, and obſerves the poſts neceſſary to be occupied for their ſafety; when he marches with a detachment, and diligently ſurveys the ground by which he may retreat, if he ſhould be attacked and repulſed by ſuperior forces, taking care that he may not be ſurrounded, and that the enemy may not be able to oppoſe to him a front more extenſive than his own.

The quick eye is no other than that penetrating genius, which lets nothing eſcape it; that looks into the heart, and diſcovers the lighteſt impreſſions which can diſorder it. A General who knows how to unite this quality with perpetual coolneſs, never is in want of expedients; he will ſee how theſe events, which to any other would be the preſage of his own defeat, may end in the overthrow of his enemies.

The army of Cyrus, in the preſence of that of Crœſus, at Timbrea, took a clap of thunder for a bad omen. This impreſſion did not eſcape the quick eye of Cyrus; but the coolneſs which on this occaſion he knew how to preſerve, ſuggeſted to him an interpretation which removed his ſoldiers fears. "My friends, cried he, Heaven declares for us: come on! I hear the ſound of victory. Great Jupiter, we follow thee!"

The choice of the general officers depends upon this genius, which diſcovers every thing: they ſhould be the right-hand of the General in Chief, and as capable of commanding the army as himſelf.

Whatever good diſpoſitions a General may make, they muſt prove ineffectual, if not ſeconded by the general officers under his command; he cannot be every where, neither can he foreſee all exigencies that may ariſe. He is obliged to give only general orders: it is therefore the buſineſs of thoſe who command under him, to know how to take the advantage of a wrong movement of the enemy; to take upon them to attack or ſuſtain the troops which are engaged, and, as circumſtances vary, to make them advance towards the enemy, either to keep him back, or to attack him. But ſtill we muſt except the reſerve, which ſhould never march without an order from the Commander in Chief.

But the qualities already mentioned would be uſeleſs, if order and diſcipline were not ſeverely obſerved: the moſt numerous and beſt compoſed army would ſoon become little elſe than a body of rangers, who, being only united by the hope of booty, would ſeparate as ſoon as that motive ceaſed, and truſting each to his own head, or indulging his own humour, would be cut in pieces party after party: ſo that, if the General does not keep up ſubordination (the ſoul and ſtrength of diſcipline) his army will be nothing more than a troop of Tartars, acting more from the hope of plunder, than the deſire of glory. What art, and what genius, is there not requiſite to maintain this ſubordination! Too much ſeverity diſguſts the ſoldier and renders him mutinous, diſcourages him, and makes him deſert; too much indulgence ſinks him into indolence, and makes him neglect his duty: licentiouſneſs cauſes that ſubordination to ſeem burthenſome, which ſhould never in any degree be given up: he loſes that reſpect, and often that confidence, which he ſhould have towards his officers; and indulgence often makes a well-diſciplined body become a ſet of ſluggards, who march againſt their will, and who, on the moſt preſſing emergences, think only on their own ſafety.

The Romans have left us examples both of indulgence and ſeverity: no people ever took more properly the opportunities of puniſhing or forgiving. Manlius cauſed his ſon to be puniſhed with death, for a diſobedience which at any other time would have merited the honours of a triumph. Varro was applauded for an imprudence, which at another juncture would have cauſed his death. In the time of the republic, it was neceſſary to be ſevere, becauſe, as every Roman could aſpire to the ſame rank, it would have been dangerous that ſmall crimes againſt the community had remained unpuniſhed; ſuch impunity would have countenanced enterpriſes which might have deſtroyed the whole ſyſtem of their political government.

The ability, foreſight, and prudence of a General, gain him the entire confidence of both officer and ſoldier. The ſoldier indeed judges but by inſtinct, and is determined only by the event; but his judgement is not leſs infallible: that of an officer is equally juſt; but he is determined only by full conviction; he puts event out of the queſtion, and places his confidence in nothing but courage and prudence. Confidence is, again, to be acquired by affability to thoſe who are ſubordinate to us, and by ſupplying their wants before they are complained of: theſe two motives for confidence afford a plentiful and certain harveſt of laurels to the General. The preſent King of Pruſſia, Marſhal Luxembourg, Marſhal Turenne, Prince Eugene, the Duke of Marlborough, Marſhal Saxe, General Wolfe, and many others, have owed the advantages they gained of their enemies, to the confidence of the ſoldiers; who, loving their General, conſidered it as their duty to pleaſe him, and had no joy in victory, but as they ſhared it with him.

Beſides theſe qualities, which are eſſential to a General, and which all who would attain that high rank ſhould of courſe have, there are ſtill many others neceſſary to make a Great Man. A Hero requires fewer virtues: the Great Man is always a good member of the community; he conſiders humanity as his firſt duty; he is juſt, open, and unbiaſſed; his temper may be fiery, but this ardour is always regulated by prudence; he gives advice with the ſame openneſs as he would aſk it; and never aſks but of thoſe whoſe experience, which he eſtimates rather by their actions than their age, makes them capable of giving ſuch as may be truſted; he is haughty only to his enemies, free to his equals, affable to his inferiors, brave without either arrogance or raſhneſs, and eaſy of acceſs to all.

The General ſhould be acquainted with the intereſts and force of Princes (a knowledge very neceſſary in judging of the power of Princes upon whom war is made, that he may fall ſooner upon the country of him who can obſtruct his projects, than upon a Prince who, by the ſituation of his dominions and force, can make no oppoſition). In a word, a General who would merit the title of a Great Man, ſhould unite in himſelf all civil, military, and political excellence. It is by this, that he will eaſily attain to make war with ſucceſs: nothing will eſcape him: he will know, without difficulty, the genius of every country, and of the nations which compoſe the enemy's army; the abilities of the Generals who command, and the nature of the troops under them. Without theſe precautions he would never think that he could act upon certain grounds: he knows he may venture a motion with ſome troops, which he would not dare to attempt with others that are equally brave. One nation is vehement, fiery, and formidable, in the firſt onſet; another is not ſo haſty, but of more perſeverance: with the former, a ſingle inſtant determines ſucceſs; with the latter, the action is not ſo rapid, but the event is leſs doubtful.

No man is born a General, though he brings into the world with him the ſeed of thoſe virtues which make a Great Man. Cæſar, Spinola, Turenne, the great Condé, Eugene, Marlborough, Wolfe, and ſome others, ſhowed, even in their earlieſt years, ſuch qualities as ranked them above other men: they carried with them the principles of thoſe great virtues which they drew forth to action by profound ſtudy, and which they brought to perfection by the help of practice: thoſe who came after them, with perhaps fewer natural talents, have by ſtudy rendered themſelves worthy of being compared to them. Cæſar and all conquerors had this advantage, that they were able to make their own opportunities, and always acted by their own choice. A man may be a good General without being a Turenne: ſuch geniuſes are ſcarcely ſeen once in an age; but the more they are raiſed above the reſt of mankind, the more they ſhould excite emulation. It is by endeavouring to ſurpaſs the intellects of the ſecond rate,—it is by ſtriving to ſurpaſs, or at leaſt to equal the moſt ſublime, that the imitation of them is to be attained. This paſſion in a ſoldier is neither pride, nor preſumption; it is virtue; and it is by this only, that he can hope to be ſerviceable to the State, and add to the glory of his King.

How much ſoever the honour of commanding armies may be ſought after, it degrades him who is not worthy of it: this rank, ſo much deſired, borders on the two extremes of glory and ignominy. A military man, who labours to make himſelf capable of commanding, is not to be blamed; his ambition is noble: by ſtudying the art of commanding, he learns that of obeying, and of executing.

I ſhould be aſtoniſhed in the higheſt degree, if I ſaw ſoldiers thinking only on preferment, and neglecting the ſtudy of their buſineſs; I ſhould perhaps wonder leſs if I ſaw others, without having been tried, propoſing to themſelves to command in chief; becauſe ſuch attempts ſuppoſe in the projector an abſurd temerity, founded on a profound ignorance of the talents he ſhould have, and the virtues which he has not. Such boldneſs is the character of a man whoſe mind is too narrow to perceive his danger. I ſhould rather approve the timidity that ſuffers itſelf to be dejected by terror, ſince it ſhows, at leaſt, that he knows to what hazards he is expoſed. Both are blameable. Modeſty is the only proper quality of a ſoldier; it gives ſplendor to virtue; it argues diffidence of himſelf, and a deſire of arriving at perfection.

Mardonius, Xerxes's General, propoſed himſelf to the King to command his armies: this conceit of his own talents ſhould have been anſwered by a refuſal: the innumerable troops which he led were defeated by a ſmall number of Greeks, and his preſumption ſerved but to increaſe the misfortune of his Prince. Cincinnatus, endowed with every quality, both of a great man and a great ſoldier, was holding his plough when the Romans came to intruſt the fate of the republic to him: he ſet out, and Rome was delivered from her enemies.

The title of General would be leſs tempting, if proper attention was paid to the qualities it requires, and the duties it impoſes: it would then appear a very honourable, it painful burthen. The moſt firm and intrepid genius might be diſcouraged, merely thinking that on the conduct of a General depends the fate of his country, the of his Prince's arms, and his own reputation.

yet the reward that follows ſuch irkſome labours ſhould animate men to under- hem. Obſtacles, however numerous they may be, are not inſurmountable, ſince ny great men have got the better of them: difficulties ſhould ſtir up a ſoldier's lation, but ſhould never terrify him; he ſhould endeavour to copy ſuch great originals, though he may not be able to equal them.

This work has engaged my utmoſt application for ſome years. Several performances on the ſame ſubject have already appeared in different languages, but none in our own, except Watſon's *Military Dictionary*, and a *New Military Dictionary*; *or The Field of War, by a Military Gentleman*. Far from exhibiting an enlarged and comprehenſive view of military affairs, theſe productions are extremely imperfect, according to the very circumſcribed plan which their authors have adopted; the firſt being only a ſmall duodecimo pamphlet, and the latter containing an account of the moſt remarkable battles, ſieges, bombardments, and expeditions, whether by ſea or land; ſuch as relate to Great-Britain and her dependencies, deduced from the deſcent of Julius Cæſar to the year 1760, in alphabetical order. Theſe, together with our beſt dictionaries of arts and ſciences, are ſo very imperfect and obſolete in the different terms and machinery of war, as not only to be very vague and perplexed, but even unintelligible. With regard to its internal government in action, to the general regulations of the line of battle, of marches, retreats, encampments, ſieges, mining, artillery, and to the principal movements in manœuvring and tactics, they are almoſt totally ſilent. Had any of theſe works been executed with tolerable ſucceſs, our various military authors would not have been under the neceſſity of adding a vocabulary to the end of their works, to explain the military terms they made uſe of.

The ſtudy of the Art of War is generally allowed to be the moſt difficult of any; yet I am of opinion, that this art, like all others, is founded on certain and fixed principles, which are by their nature invariable: the application of them only can be varied; but they are in themſelves conſtant. This moſt difficult ſcience may, I think, be divided into two parts. The one is mechanical, and may be taught by precepts: the other has no name, nor can it be defined or taught: however, it conſiſts in a juſt application of the principles and precepts of war, in all the numberleſs circumſtances and ſituations which occur: no rule, no ſtudy or application, however aſſiduous; no experience, however long, can teach this part: it is the effect of genius alone. As to the firſt, it may be reduced to mathematical principles; its object is, to prepare the materials which form an army, for all the different operations which may occur: genius muſt apply them according to the ground, numbers, ſpecies, and quality of the troops, which admit of almoſt infinite combinations.

But, as this laborious taſk requires too much time to be attempted by the far greater part of thoſe who are deſirous of being thoroughly acquainted with the military arts and ſciences, in their preſent ſtate of improvement and perfection; this DICTIONARY is offered to the Public as a great help to that branch of knowledge: and I hope that the great pains I have taken, and the many years I have ſpent, in compoſing and perfecting this work, will render it an acceptable acquiſition to my Country.

Animated with a ſincere deſire of making myſelf uſeful to the Public, I undertook this laborious taſk, and have exerted all my abilities to remove every difficulty, and ſmooth the path that leads to the temple of military ſciences.

In order to effectuate this, I have been particularly careful to explain, in the moſt conſpicuous and intelligible manner, the principles upon which every branch of the art of war is founded; and from theſe general principles, I have deduced and eluci
the various terms in martial diſcipline, fortification, gunnery, mining, and ſieges;
ticularly thoſe now actually practiſed by the moſt famous belligerant powers in Eu

How far this work may prove advantageous, muſt be left to time and experien
only hope, that an undertaking ſo evidently calculated to promote the milita
cannot fail of meeting with encouragement, in an age when heroic proweſs
to the ſummit of perfection.

Royal MILITARY ACADEMY,
Woolwich, Nov. 25, 1778.

GEORGE SMITH.

Principal

Principal AUTHORS *peruſed in compiling the following WORK.*

ACQUINI Lexicon Militare, 2 vol. folio.
Newtoni Principia Philoſophiæ Naturalis, cum comment. perp. ſtudio *Le Suer & Jacquier*, 4 vol. 4to.
Le Parfait Ingénieur François, par l'*Abbé Dedier*, 4to.
Œuvres de *M. le Blond.* 8vo.
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Speckle, Architectur von Feſtungen, folio.
Zuckouw's Kriegs Baukunſt, 4to.
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Eſſai ſur l'uſage de l'artillerie, p. *Puget*, 8vo.
Tielke's Kriegs Schriften, in 4to. und 8vo.
Anderſon's Art of War, 8vo.

ERRATA.

ARTILLERY-*Park*, line 10, for *incampment*, read *encampment*.
Incampment of a regiment of ARTILLERY, read *Encampment*.
ASSEMBLEE, read ASSEMBLY.
BATTERING-*Train*, line 5, for *the* 10 *and* 8-*inch*, read *the* 13, 10, *and* 8-*inch*.
Shoulder-BELTS, line 2, for, *and to which the pouch fixed*, read *and to which the pouch* is *fixed*.
BOYAU, line 5, for, *that it may be enfiladed*, read *that it may* not *be enfiladed*.
BULLETS, table thereof, laſt figure in the head column, which ſtands 6, read 9.
Ancient and preſent names of Cannon, at the paragraph, *ſhip-guns*, for 42, 36, 32, read 42, 32, &c.
CANTONMENTS, line 3, for *incampment*, read *encampment*.
COURT-*Martial*, line 2, for *offiences*, read *offences*.
COMPLEMENT, read COMPLIMENT.
DAGGER, line 3. for, *it is not long that ſince*, read, *it is not long ſince that*, &c.
How to find the DIAMETER, line 26, for 0586971$\frac{1}{2}$, read, 0586971$\frac{3}{2}$.
FORGE. *Dimenſions of a travelling*-FORGE, for *fore-wheels height* 104, read 64; for *hind-wheels height* 64, read 104.
Dimenſions of tin TUBES, &c. firſt column, for 5$\frac{1}{2}$ *royal coborn*, dele *coborn*; alſo, for 4$\frac{2}{5}$ *royal coborn*, dele *royal*.
WHEEL, art. 11, line 10, for $\frac{F}{w}$, read $\frac{F}{W}$, &c. Art. 14, line 6, for *to the R*, read *to R*.

SUPPLEMENT.

CAMP, at the paragraph, *Diſtribution of the front and depth of the* CAMP, *for a battalion of infantry*, line 11, for, *the depth* 759 *feet, formerly* 960, dele the whole.
LABORATORY, in the *table of fuzes*, at the 9th column, top line, for 35 *to* 3, read 35 *to* 38.
LABORATORY, *table of ſhells ranges*, &c. at *Example* 2, line 10, for $\sqrt{2216}$, read $\sqrt{2316}$.

MILITARY DICTIONARY

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ABBATIS, in a military ſenſe, is formed by cutting down many entire trees, the branches of which are turned towards the enemy, and as much as poſſible entangled one into another. They are made either before redoubts, or other works, to render the attacks difficult, or ſometimes along the ſkirt of a wood, to prevent the enemy from getting poſſeſſion of it. In this caſe the trunks ſerve as a breaſt-work, behind which the troops are poſted, and for that reaſon ſhould be diſpoſed, ſo as that the parts may, if poſſible, flank each other.

ABSOLUTE *Gravity*, in philoſophy, is the whole force by which a body, ſhell, or ſhot, is impelled towards the center. See GRAVITY.

ABSOLUTE *Number*, in Algebra, is the known quantity which poſſeſſes entirely one ſide of the equation. Thus, in the equation, $xx + 10x, = 64$, the number 64, poſſeſſing entirely one ſide of the equation, is called the *abſolute number*, and is equal to the ſquare of the unknown root x, added to $10x$, or to 10 times x.

ACADEMY, in antiquity, the name of a villa ſituated about a mile from the city of Athens, where Plato and his followers aſſembled for converſing on philoſophical ſubjects; and hence they acquired the name of Academics.

Military ACADEMY. We have in England two royal military academies, one at Woolwich, and one at Portſmouth. The firſt was eſtabliſhed by his late Majeſty king George II. by warrants bearing date the 30th day of April, and the 18th day of November, 1741, endowed, and ſupported, for the inſtructing of the people belonging to the military branch of ordnance, in the ſeveral parts of mathematics neceſſary to qualify them for the ſervice of the artillery, and the buſineſs of engineers. The lectures of the maſters in theory were then duly attended by the practitioner-engineers, officers, ſerjeants, corporals, private men, and cadets. At preſent the gentlemen educated at this academy are the ſons of the nobility and military officers. They are called gentlemen-cadets, and are not admitted under 13 years of age. They are taught writing, arithmetic, algebra, Latin, French, mathematics, mechanics, ſurveying, levelling, and fortification, together with the attack and defence; gunnery, mining, laboratory-works, geography, perſpective, fencing, dancing, &c. The maſter-general of the ordnance is always captain of the company of gentlemen-cadets, and ſome officer of merit is always captain-lieutenant. There is, beſides, a firſt lieutenant, and two ſecond lieutenants. They are further under the immediate care of a lieutenant-governor, and an inſpector, who are officers of great abilities and experience; and the profeſſors and maſters are men of known talents and capacity. That at Portſmouth was founded by George I. in 1722, for teaching thoſe branches of the mathematics which more immediately relate to navigation.

ACCELERATED *Motion*.
- *on oblique or inclined planes*. See MOTION.
- *of pendulums*. See PENDULUMS.
- *of projectiles*. See PROJECTILES.

ACCENSI, in antiquity, were officers attending the Roman magiſtrates; their buſineſs was to ſummon the people to the public games, and to aſſiſt the prætor when he ſat on the bench.

Accenſi, in the Roman armies, were, according to Feſtus, ſupernumerary ſoldiers, whoſe duty it was to attend their leaders, and ſupply the places of thoſe who were either killed or wounded. Livy mentions them as irregular troops, who were but little eſteemed. Salmaſius tells us, they were taken out of the fifth claſs of the poor citizens of Rome.

ACCESSIBLE, that which may be approached. We ſay, in a military ſtile, that place, or that fortreſs, is *acceſſible* from the ſea, or land, i. e. which may be entered on thoſe ſides.

An acceſſible height or diſtance, in geometry, is that which may be meaſured by applying a rule, &c. to it; or rather, it is a height, the foot whereof may be approached, and from whence any diſtance may be meaſured on the ground.

Heights, both acceſſible, and inacceſſible, may be taken with a quadrant. See ALTITUDE.

One of the objects of ſurveying, is the meaſuring both acceſſible and inacceſſible diſtances.

ACCLIVITY, in a military ſenſe, is the ſteepneſs or ſlope of any work, inclined to the horizon, reckoned upwards. Some writers on fortification uſe acclivity as ſynonymous to *talus*; though *talus* is commonly uſed to denote all manner of ſlopes, either in its aſcendent or deſcendent ſtate.

ACCOUTREMENTS, in a military ſenſe, ſignifies habits, equipage, or furniture, of a ſoldier, ſuch as buffs, belts, pouches, cartridge-boxes, &c.

ACLIDES, in Roman antiquity, a kind of miſſive weapon, with a thong fixed to it, whereby it might be drawn back again. Moſt authors deſcribe the *aclides* as a ſort of dart or javelin; but Scaliger makes it roundiſh or globular, with a wooden ſtem to poiſe it by.

ACTIAN *games*, in antiquity, were ſolemn games inſtituted, or at leaſt reſtored, by Auguſtus, in memory of the famous victory, at Actium, over Mark Anthony.

ACTIAN *years*, in chronology, a ſeries of years, commencing with the epocha of the battle of Actium, otherwiſe called the æra of Auguſtus.

ACTION, in the military art, is an engagement between two armies, or any ſmaller body of troops, or between different bodies belonging thereto. The word is likewiſe uſed to ſignify ſome memorable act done by an officer, ſoldier, or even commander of a detachment or party.

ACTIVITY, in a military ſenſe, denotes laboriouſneſs, attention, labour, diligence and ſtudy.

ACUTE *angle*. See ANGLE.

ADJUTANT-GENERAL is an officer of diſtinction, who aids and aſſiſts the general in his laborious duty: he forms the ſeveral details of duty of the army, with the brigade-majors, and keeps an exact ſtate of each brigade and regiment, with a roll of the lieutenant-generals, major-generals, colonels, lieutenant-colonels, and majors. He every day at head quarters receives orders from the general officer of the day, and diſtributes them to the majors of brigades, from whom he receives the number of men they are to furniſh for the duty of the army, and informs them of any detail which may concern them. On marching days he accompanies the general to the ground of the camp. He makes a daily report of the ſituation of all the poſts placed for the ſafety of the army, and of any changes made in their poſts. In a day of battle the adjutant-general ſees the infantry drawn up, after which he places himſelf by the general to receive any orders. In a ſiege he viſits the ſeveral poſts and guards of the trenches, and reports their ſituation, and how circumſtanced: he gives and ſigns all orders for ſkirmiſhing parties (if time permits) and has a ſerjeant from each brigade to carry any orders which he may have to ſend.

ADJUTANT, an officer who eaſes the major of part of the burthen of his duty, and performs it all in his abſence. He receives orders from the brigade-major, if in camp; and when in garriſon, from the town-major: after he has carried them to his colonel or officer commanding the regiment, he then aſſembles the ſerjeant-major, drum-major, and fife-major, with a ſerjeant and corporal of each company, who write the orders to ſhew to their reſpective officers. If convoys, parties, detachments, or guards, are to be furniſhed, he gives the number which each company are to furniſh, and hour and place for their aſſembling: he muſt keep an exact roſter and roll of duties, and have a perfect knowledge of all manoeuvres, &c. Each troop of guards has two adjutants, every regiment of foot has one, and each battalion of the royal artillery one. This poſt is always given to a ſubaltern.

ADVANCEMENT, in a military ſenſe, ſignifies honour, promotion, or preferment, in the army, regiment, or company.

ADVANCED { Fosse. } See Fortification.
{ Ditch. }
{ Guard. See Guard.

AFFIDAVIT, in military law, ſignifies an oath taken before ſome perſon who is properly authorized to take it; as firſt, when a ſoldier is inliſted; ſecondly, by all officers appointed for a court-martial; thirdly, by the commiſſaries, or muſter-maſters.

AFFUT, the French name for a gun-carriage, and for which we have no proper name; the only diſtinction from all other carriages is, that it belongs to a gun. See Carriage.

AGA, in the Turkiſh army, is the ſame as a general with us.

AGENT, to a regiment or battalion, ſignifies a perſon entruſted with all the money belonging to both officers and private men: he keeps exact accounts of the arrears of commiſſioned officers, in regard to ſubſiſtence, poundage, hoſpital, widows, and off-reckonings. He is generally appointed by the colonel of the regiment.

AGIADES, in the Turkiſh armies, are a kind of pioneers employed in fortifying the camp, &c. This word frequently occurs in hiſtory.

AID-DE-CAMP, an officer appointed to attend a general officer, in the field, in winter-quarters, and in garriſon; he receives and carries their orders, as occaſion requires. He is ſeldom under the degree of a captain, and all aids-de-camp have 10s. a day allowed for their duty. This employment is of greater importance than is generally believed: it is, however, often entruſted to young officers of little experience, and of as little capacity; but in moſt foreign ſervices they give great attention to this article. Marſhal de Puyſſegur mentions the loſs of a battle through the incapacity of an aid-de-camp.

King's Aids-de-Camp, are frequently officers of note; and by this promotion they always rank as colonels.

AID-MAJOR. See Adjutant.

AIM-FRONTLET, a piece of wood hollowed out to fit the muzzle of a gun, to make it of an equal height with the breech, formerly made uſe of by the gunners, to level and direct their pieces. It is not uſed at preſent.

AIR-GUN, a pneumatic machine for exploding bullets, &c. with great violence.

The common air-gun is made of braſs, and has two barrels: the inſide barrel is of a ſmall bore, from whence the bullets are exploded; and a large barrel on the outſide of it. There is likewiſe a ſyringe fixed in the ſtock of the gun, by which the air is injected into the cavity between the two barrels through a valve. The ball is put down into its place in the ſmall barrel with the rammer, as in any other gun. Another valve, being opened by the trigger, permits the air to come behind the bullet, ſo as to drive it out with great force. If this valve be opened and ſhut ſuddenly, one charge of condenſed air may be ſufficient for ſeveral diſcharges of bullets; but if the whole air be diſcharged on one ſingle bullet, it will drive it out with uncommon force. This diſcharge is effected by means of a lock placed here, as uſual in other guns; for the trigger being pulled, the cock will go down and drive the lever, which will open the valve, and let in the air upon the bullet.

In the air-gun, and all other caſes where the air is required to be condenſed to a very great degree, it will be requiſite to have the ſyringe of a ſmall bore, viz. not exceeding half an inch in diameter; becauſe the preſſure againſt every ſquare inch is about 15 pounds, and therefore againſt every circular inch about 12 pounds. If therefore the ſyringe be one inch in diameter, when one atmoſphere is injected, there will be a reſiſtance of 12 pounds againſt the piſton; and when 10 are injected, there will be a force of 120 pounds to be overcome; whereas 10 atmoſpheres act againſt the circular half-inch piſton (whoſe area is only ¼ part ſo big) with only a force equal to 30 pounds; or 40 atmoſpheres may be injected with ſuch a ſyringe, as well as 10 with the other. In ſhort, the facility of working will be inverſely as the ſquares of the diameter of the ſyringe.

AIR-SHAFTS, in mining. See Mining.

AJUTANT. See Adjutant.

ALARM, is a ſudden apprehenſion upon ſome report, which makes men run to their arms to ſtand upon their guard; it implies either the apprehenſion of being ſuddenly attacked, or the notice given of ſuch an attack being actually made; generally ſignified by the firing of a cannon, the beat of a drum, &c.

Alarm-*Poſt*, in the field, is the ground appointed by the quarter-maſter general for each regiment to march to, in caſe of an alarm.

Alarm-*Poſt*, in a garriſon, is the place allotted by the governor for the troops to draw up in, on any ſudden alarm.

***Falſe*-Alarms**, are ſtratagems of war, frequently made uſe of to harraſs an enemy, by keeping them perpetually under arms. They are often conveyed by falſe reports, occaſioned by a fearful or negligent ſentinel. A vigilant officer will ſometimes make a falſe alarm, to try if his guards are ſtrict upon duty.

Alarm-*Bell*, the bell rung upon any ſudden emergency, as a fire, mutiny, approach of an enemy, or the like.

Knights of ALCANTARA, a Spaniſh military order, who gained great honour during the wars with the Moors.

ALIEN, in law, implies a perſon born in a foreign country, not within the king's dominions, in contradiſtinction to a denizen, or natural-born ſubject.

ALLEGIANCE, in law, implies the obedience which every ſubject ought to pay to his lawful ſovereign.

Oath of Allegiance, is that taken by the ſubject, by which he acknowledges the king his lawful ſovereign.

ALLIANCE, in a military ſenſe, ſignifies a treaty entered into by ſovereign princes and ſtates, for their mutual ſafety and defence. In this ſenſe alliances may be diſtinguiſhed into ſuch as are offenſive, whereby the contracting parties oblige themſelves jointly to attack ſome other power, and into ſuch as are defenſive, whereby the contracting powers bind themſelves to ſtand by, and defend one another, in caſe of being attacked by any other power.

ALLOY, is the mixture of metals that enter into the compoſition of the metal proper for cannon and mortars.

ALMADIE, a kind of military canoe, or ſmall veſſel, about 24 feet long, made of the bark of a tree, and uſed by the negroes of Africa.

Almadie, is alſo the name of a long-boat uſed at Calcutta, near 80 feet long, and generally ſix or ſeven broad.

ALTITUDE, height, or diſtance from the ground, meaſured upwards, and may be both acceſſible and inacceſſible.

Altitude *of motion*, a term uſed by ſome writers, to expreſs the meaſure of any motion, computed according to the line of direction of the moving force.

AMAZON, one of thoſe women who inhabited the country ſo called. They are ſaid to have compoſed a nation of themſelves, excluſive of males, and to have derived their name from their cutting off one of their breaſts, that it might not hinder or impede the exerciſe of their arms. This term has often by modern writers been uſed to ſignify a bold daring woman, whom the delicacy of her ſex does not hinder from engaging in the moſt hazardous attempts. The laſt and former wars with France have furniſhed us with ſeveral inſtances of females who have undergone the fatigue of a campaign with alacrity, and run the hazards of a battle with the greateſt intrepidity.

AMBITION, in a military ſenſe, ſignifies a deſire of greater poſts, or preferment. Every gentleman in the army, or navy, ought to have a ſpirit of ambition to arrive at the very ſummit of their profeſſion.

AMBUSCADE, in military affairs, implies a body of men poſted in ſome ſecret or concealed place, 'till they find an opportunity of falling upon the enemy by ſurpriſe: or, they are rather ſnares ſet for the enemy, either to ſurpriſe them when marching without precaution, or by poſting yourſelf advantageouſly, and drawing them there by different ſtratagems, to attack them by ſuperior force. An ambuſcade is eaſily carried into execution in woods, buildings, and hollow places; but requires a more fertile imagination, and greater trouble, in a level country.

AMBUSH, a place of concealment for ſoldiers to ſurpriſe an enemy, by falling ſuddenly upon them.

AMENDE *Honorable*, in the French cuſtoms, is an infamous kind of puniſhment inflicted upon traitors, paricides, or ſacrilegious perſons, in the following manner: the offender being delivered into the hands of the hangman, his ſhirt is ſtripped off, a rope put about his neck, and a taper in his hand; then he is led into court, where he muſt beg pardon of God, the king, the court, and his country. Sometimes the puniſhment ends here; but ſometimes it is only a prelude to death, or baniſhment to the gallies.

AMMUNITION, implies all ſorts of warlike ſtores, and more particularly powder and ball, cannon, mortars, howitzers, cohorns, royals, ſhells, bullets, cartridges, grape-ſhot, tin, and caſe-ſhot; carcaſſes, granades, pontoons, ſmall-arms, ſwords, forage, ſtores, &c.

Ammunition *bread*, *ſhoes*, *cloths*, &c. ſuch as are ſerved out by the governement, to the ſoldiers of an army, garriſon, &c. The bread that is provided for, and diſtributed to the ſoldiers, is a loaf of ſix pounds every four days to each ſoldier.

Ammunition-*waggon*, is generally a four-wheel carriage with ſhafts; the ſides are railed in with ſtaves and raves, and lined with wicker-work, ſo as to carry bread and all ſorts of tools. It is drawn by four horſes, and loaded with 1200 pound weight. See Waggon.

Ammunition-*cart*, a two-wheel carriage with ſhafts; the ſides of which, as well as the fore and hind parts, are incloſed with boards inſtead of wicker-work.

AMNESTY, in a military or political ſenſe, is an act by which two belligerent powers at variance promiſe to forget and bury in oblivion all that is paſt.

Amnesty is either general and unlimited, or particular and reſtrained, though moſt commonly univerſal, without conditions or exceptions; ſuch as that which paſſed in Germany at the peace of Oſnabrug in the year 1648.

Amnesty, in a more limited ſenſe, denotes a pardon granted by a prince to his rebellious ſubjects, uſually with ſome exceptions; ſuch as was granted by Charles II. at his reſtoration.

AMORCE, an old military word for fine-grained powder, ſuch as is ſometimes uſed for priming of great guns, mortars or howitzers; as alſo for ſmall-arms, on account of its rapid inflammation.

AMPLITUDE *of the range of a projectile*. See Projectile.

ANABASII, in antiquity, were expeditious couriers, who carried diſpatches of great importance, in the Roman wars.

ANCYLE, in antiquity, a kind of ſhield which fell, as was pretended, from heaven, in the reign of Numa Pompilius; at which time, likewiſe, a voice was heard, declaring that Rome ſhould be miſtreſs of the world as long as ſhe ſhould preſerve this holy buckler.

Authors are much divided about its ſhape: however, it was kept with great care in the temple of Mars, under the direction of twelve prieſts; and, leſt any ſhould attempt to ſteal it, eleven others were made ſo like it, as not to be diſtinguiſhed from the ſacred one. Theſe *Ancylia* were carried in proceſſion every year round the city of Rome.

St. ANDREW, *or the Thiſtle*, a military order of knighthood in Scotland. The occaſion of inſtituting this order is variouſly related by different authors. John Leſley, biſhop of Roſs, reports, that the night before the battle betwixt Athelſtane, king of England, or rather Northumberland, and Hungus, king of the Picts, a bright croſs, in the faſhion of that whereon St. Andrew ſuffered martyrdom, appeared in the air to Hungus; he having gained the victory, bore the figure of that croſs at all times after in his enſigns and banners, from which time all ſucceeding kings of Scotland have religiouſly obſerved the ſame bearing. Others aſſert, that this extraordinary appearance was not to Hungus, but to the Scots, whom Achaius, king of Scotland, ſent to his aſſiſtance. This victory is ſaid to be obtained in the year 819 (though, according to Buchanan, Achaius died nine years before) and that Hungus and Achaius went bare footed in ſolemn proceſſion to the kirk of St. Andrew, to return thanks to God and his apoſtle, promiſing that they and their poſterity would ever uſe in their enſigns the croſs of St. Andrew; which cuſtom prevailed among the Picts, and continued among the Scots unto this day: and that both theſe kings inſtituted an order, which they named the order of St. Andrew.

Others, who allow that Achaius inſtituted this order, give the following account of its origin: Achaius having formed that famous league, offenſive and defeſive, with Charlemagne, againſt all other princes, found himſelf thereby ſo ſtrong, that he took for his device the *Thiſtle* and the *Rue*, which he compoſed into a collar of his order, and for his motto, *Pour ma defenſe*; intimating thereby, that he feared not the powers of foreign princes, ſeeing he leaned on the ſuccour and alliance of the French. And though from hence may be inferred, that theſe two plants, the Thiſtle and the Rue, were the united ſymbols of one order of knighthood, yet Menenius divides them into two, making one whoſe badge was the Thiſtle, whence the knights were ſo called, and the motto, *Nemo me impune laceſſit*; another vulgarly called *Sertum rutæ*, or the garland of rue; the collar of which was compoſed of two branches or ſprigs thereof, or elſe of ſeveral of its leaves: however, at both theſe collars hung one and the ſame jewel, to wit, the figure of St. Andrew, bearing before him the croſs of his martyrdom.

But though the thiſtle has been acknowledged for the badge and ſymbol of the kingdom of Scotland, even from the reign of Achaius, as the roſe was of England, and the lily of France, the pomegranate of Spain, &c. yet there are ſome who refer the order of the thiſtle to later times, in the reign of Charles VII. of France, when the league of amity was renewed between that kingdom and Scotland, by which the former received great ſuccour from the latter, in the time of an extraordinary diſtreſs. Others again place the foundation ſtill later, even as low as the year 1500; but without any degree of certainty.

The chief and principal enſign of this order is a gold collar, compoſed of thiſtles, interlinked with annulets of gold, having pendent thereto the image of St. Andrew with his croſs, and this motto, *Nemo me impune laceſſit*.

Knights of St. Andrew, is alſo an order inſtituted by Peter the Great, of Muſcovy, in 1698; the badge of which is a golden medal, on one ſide whereof is repreſented St. Andrew's croſs; and on the other are theſe words, *Czar Pierre monarque de toute la Ruſſie.* This medal, being faſtened to a blue ribbon, is ſuſpended from the right ſhoulder.

ANGLE, in geometry, is the inclination of two lines meeting one another in a point.

Thus if the line *C B* (*plate I. fig.* 1.) meet the line *D B*, in the point *B*, their inclination towards each other is called an angle.

Sometimes angles are denoted by a ſingle letter placed at the point of interſection; as the angle *B* *fig.* 2.) imports the angles formed by the lines *A B*, *C B*, at the point *B*. But when ſeveral lines meet at the ſame point, as at *B* (*fig.* 3.) each particular angle is denoted by three letters, whereof the middle letter ſhews the angular point, and the other two letters the lines which form that angle. Thus the angle formed by the lines *A B*, *C B*, at the point *B*, is called the angle *A B C*, or *C B A*.

The meaſure of an angle is the arch of a circle, deſcribed on the angular point, intercepted between the two lines which form the angle. Thus the meaſure of the angle *A B C* (*fig.* 3.) is the dotted arch intercepted between the two legs *A B*, *C B*; and as many degrees, &c. as are contained in that arch, ſo many degrees, &c. the angle *A B C* is ſaid to conſiſt of.

Hence it will be eaſy to meaſure the quantity of any angle geometrically; for if you take the diſtance of the arch intercepted between the lines *A B*, *C B*, and apply it to a line of chords, whoſe radius is *B E*, you will have the number of degrees, &c. contained in the angle *A B C*. Or if you apply the center of a protractor to the angular point *B*, in ſuch a manner that the leg *A B* lies directly under the limb of the protractor, the degree on the arch cut by the other leg *B C* will give the quantity of the angle required.

ANGLES are either *right*, *acute*, or *obtuſe*.

A Right ANGLE, is that whoſe two legs are perpendicular to each other; and conſequently the arch intercepted between them is exactly 90°. Thus the angle *A B C* (*fig.* 2.) is a right angle.

An Acute ANGLE, is that which is leſs than a right angle, or 90°. as the angle *C B D*, *fig.* 1.

An Obtuſe ANGLE, is that which is greater than a right angle; as *A B C*, *fig.* 1.

Adjacent ANGLES, are ſuch as have the ſame vertex, and one common ſide contained beyond the angular point. Thus the angle *C B D*, and *C B A* (*fig.* 1.) are adjacent angles. The ſum of theſe adjacent angles is always equal to two right angles (13. *Eucl.* 1.) and therefore, if one of them be acute, the other will be obtuſe; and the contrary: whence, if either of them be given, the other is alſo given, it being the complement of the former to 180°.

Vertical ANGLES, are the oppoſite angles made by two lines cutting or croſſing each other. Thus, if the right lines *A B*, *C B* (*fig.* 4.) cut or croſs each other in the point *E*, then the angles *A E C*, *D E B*, and *A E D*, *C E B*, are vertical angles. Hence, when two lines cut or croſs each other, the vertical angles are equal (15. *Eucl.* 1.)

Alternate ANGLES, are thoſe cut or obtuſe angles made by two lines cutting or croſſing each other, and formed by a right line cutting or croſſing two parallel lines. Thus, if *A B* (*fig.* 5.) be parallel to *C D*, and the line *G H* cuts them in *I* and *K*, then are the angles *A I K*, *D K I*, and *B I K*, *I K C*, alternate angles. Theſe alternate angles are always equal to each other (18. *Eucl.* 1.)

A Rectilinear ANGLE, is made by ſtrait lines, to diſtinguiſh it from the ſpherical or curvilinear angle.

Spherical ANGLE, is an angle formed by the interſection of two great circles of the ſphere. Thus let *A C D E* (*fig.* 6.) repreſent a ſphere, upon whoſe ſurface let two arches of great circles *A B*, *C E*, be drawn interſecting each other in *D*; then will *A D C*, *D C A*, *B D E*, or *D B E*, be a ſpherical angle. All ſpherical angles are meaſured by an arch of a great circle deſcribed on the vertex as a pole, and intercepted between the legs which form the angle. Thus *A C* is the meaſure of the ſpherical angle *A D C*, which is equal to the diſtance between the poles of the circles *A B*, *C E*.

Mixed-lined ANGLE, is that comprehended between a right line and a curved line; as the angle *A B C* (*fig.* 1.)

Curved-line ANGLE, is that intercepted between two curved lines meeting each other in one point, in the ſame plane; as the angle *B C A* (*fig.* 8.) which is intercepted between the two curved lines *A C* and *B C*. If the right lines *D C*, *E C*, are equal to the radii of the curves *B C* and *A C*, the right-lined angle *D C E* will be equal to the curved-line angle *A C B*. For, becauſe the angle *D C B* = *E C A*, therefore, if from each be taken the common angle *D C A*, there will remain the angle *D C E* = *A C B*.

ANGLE *of Incidence*, is that which the line of direction of a ray of light, &c. makes at the point where it firſt touches the body it ſtrikes againſt, with a line erected perpendicular to the ſurface of that body. Thus, if a ray of light, &c. moves in the direction *A B* (*fig.* 3.) till it touches the ſurface *a b c d*, in the point *B*, then will the angle intercepted between *A B*, the line of direction, and the perpendicular *B F*, be the angle of incidence.

ANGLE *of Reflection*, is the angle intercepted between the line of direction of a body rebounding, after it was ſtruck againſt another body, and a perpendicular erected at the point of contact. Thus, if a body moving in the direction *A B* ſtrike the ſurface *a b c d* (*fig.* 3.) in the point *B*, and is reflected in the direction *B C*, the angle, contained between that line and the perpendicular *B F*, is called the angle of reflection. The angle of incidence is always equal to the angle of reflection; and upon this equality the whole ſcience of catoptrics is founded.

ANGLE *at the center*, in fortification, is that which is formed in the center of the polygon or figure, by two lines proceeding from the center, and terminating at the two neareſt angles of the polygon. See FORTIFICATION.

ANGLE *of the curtain*, } That which is made
ANGLE *of the flank*, } by, and contained
between, the curtain and the flank.

ANGLE *of the polygon*, that which is made by the meeting of the two ſides of the polygon, or figure in the center of the baſtion. See FORTIFICATION.

ANGLE *of the triangle*, is half the angle of the polygon.

ANGLE *of the baſtion*, or } That which is made
Flanked ANGLE, } by the two faces,
being the utmoſt part of the baſtion moſt expoſed to the enemies batteries, frequently called the point of the baſtion. See FORTIFICATION.

Diminiſhed ANGLE, only uſed by ſome foreign engineers, and more eſpecially the Dutch, is compoſed of the face of the baſtion, and the exterior ſide of the polygon.

ANGLE *of the ſhoulder*, or } Is formed by one
ANGLE *of the épaule*, } face, and one flank
of the baſtion. See FORTIFICATION.

ANGLE *of the tenaille*, } Is made by two lines
ANGLE *rentrant*, } fichant, that is, the
faces of the two baſtions extended, 'till they meet in an angle towards the curtain, and is that which always carries its point towards the outworks. See FORTIFICATION.

ANGLE *of the flank exterior*, is that which is before the center of the curtain, formed by the prolongation of the faces of the baſtion, or by both the fichant lines of defence, interſecting each other on planning a fortification.

ANGLE *of the flank interior*, is formed by the flanked line of defence and the curtain; being that point where the line of defence falls upon the curtain.

ANGLE *of the line of defence*, is that angle made by the flank, and the line of defence.

ANGLE *of the face*, is formed by the angle of the face, and the line of defence produced 'till they interſect each other.

ANGLE *of the baſe interior*, is the half of the figure, which the interior polygon makes with the radius, when they join each other in the center; interſecting the center of the gorges of each baſtion.

ANGLE *of the baſe exterior*, is an angle formed by lines drawn from the center of the figure, to the angle of the exterior polygon, cutting the center of the gorges of each baſtion.

ANGLE *of the gorge*, is that angle formed by the prolongation of the curtains, interſecting each other, in the center of the gorge, through which the capital line paſſes.

ANGLE *of the ditch*, is formed before the center of the curtain, by the outward line of the ditch.

Flanked ANGLE. See ANGLE *of the baſtion.*

Salient ANGLE, } Is that angle which points
ANGLE *ſortant*, } outwards, or towards the
country. Such is the angle of the counterſcarp before the point of a baſtion.

Entering ANGLE, or } An angle pointing in-
ANGLE *rentrant*, } wards, as the ſalient
angle does outwards. Such is the angle of the counterſcarp before the curtain.

ANGLE *of the counterſcarp*, made by two ſides of the counterſcarp, before the center of the curtain.

ANGLE *of the circumference*, is the mixed angle formed by an arch, drawn from one gorge to another.

Re-entering ANGLE. See *Entering* ANGLE.

ANGLE *of the complement of the line of defence*, is the angle formed by the interſection of the two complements with each other.

ANGLE *of a battalion*, made by the laſt men at the extremity of the ranks and files.

Front ANGLES, the two laſt men of the front rank.

Rear ANGLES, the two laſt men of the rear rank.

Dead ANGLE, is a re-entering angle, conſequently not defended.

ANGULAR, in a general ſenſe, denotes ſomething relating to, or that hath angles.

ANGON, in ancient military hiſtory, was a kind of dart of a moderate length, having an iron bearded head and cheeks; much in uſe about the fifth century.

To ANIMATE, in a military ſenſe, is to encourage the troops by the power of language. That art, that power, which can on ſingular and critical occaſions ſo animate the ſpirit of man, as to cauſe it to give an elaſticity, a ſtrength, a velocity, to the corporeal matter of the being, which unanimated it would be incapable of doing; ſuch art, ſuch power, muſt be ever neceſſary to a leader of ſoldiers. He who is, in particular caſes, to point out to others their duty, who is ſometimes to diſſipate their fears, rouze their courage, ſhew advantages, or leſſen unfavourable appearances, ſhould have the power to animate by ſpeech: if he has not, he himſelf may meet with diſgrace, where he might have found triumph; and his men be beat, where they might have conquered. Innumerable inſtances might be brought to prove the truth of this aſſertion. All addreſſes to animate ſoldiers have been reſerved, and uſed as laſt reſources for rare, trying, and critical ſituations; and in ſuch ſenſe alone is the power *to animate* by ſpeech here treated of.

All officers know, that in any event of danger, the ſoldiers always look at their officers, their commanding one in particular, if they have confidence in him, to ſee how he feels himſelf, whether he is unperplexed, and ſeems to be eaſy; and from his looks they will often augur good or bad ſucceſs; and from his appearance or actions often ſpring aſſurance and victory, diſmay and defeat. Actions or appearances of officers ſhould never lead to give ſoldiers room to doubt, or to form unfavourable conjectures: what they ſee from the enemy cannot be prevented; but they ſhould neither ſee, hear, nor underſtand any bad omens from their own ſide: if they ever ſee too much, means, if poſſible, ſhould be made uſe of, to make them diſtruſt and forget their own ſight, and ſee only through the medium of their commanding officer's words and inclinations. Animation, like electricity, is communicated, is catching; and the officer who is animated himſelf, will inſpire others.

All hiſtory, particularly the ancient, preſents numbers of examples of armies, of ſmall parties, extricating themſelves from dangerous and alarming ſituations, through the exhortations of their chiefs; and when any chief directs the method of eſcape, or ſhews the road to victory, by a few words; and with his perſon, if neceſſary, ſets the example of actual execution, armies, and parts of armies, in general will eſcape, and will conquer. If ſoldiers opinions are then to be changed by words, or by appearances, and from ſuch change of opinion, victory will often enſue; hence to animate by ſpeech at particular times, becomes a matter of the utmoſt importance.

ANNALS, a ſpecies of military hiſtory, wherein events are related in the chronological order they happened. It differs from a perfect hiſtory, in being only a meer relation of what paſſes every year, as a journal is of what paſſes every day.

ANNUNCIADA, an order of military knighthood in Savoy, firſt inſtituted by Amadeus I. in the year 1409; their collar was of 15 links, interwoven one with another, and the motto *F. E. R. T.* ſignifying *fortitudo ejus Rhodum tenuit.* Amadeus VIII. changed the image of St. Maurice, patron of Savoy, which hung at the collar, for that of the Virgin Mary; and inſtead of the motto above mentioned, ſubſtituted the words of the angel's ſalutation.

ANOLYMPIADES. See OLYMPIAD.

ANSPESADE. See LANCE CORPORAL.

ANTEMURALE, in the ancient military art, denotes much the ſame with that the moderns call the outworks.

ANTESTATURE, in ancient fortification, ſignifies an intrenchment of palliſades or ſacks of earth, thrown up in order to diſpute the remainder of a piece of ground.

ANTHONY, or *Knights of St. Anthony*, a military order inſtituted by Albert, duke of Bavaria, Holland, and Zeland, when he deſigned to make war againſt the Turks in 1382. The knights wore a collar of gold made in the form of a hermit's girdle, from which hung a ſtick like a crutch, with a little bell, as they are repreſented in St. Anthony's pictures.

APPAREILLE, are thoſe ſlopes that lead to the platform of the baſtion. See FORTIFICATION.

APPAREILLES, are eaſy aſcents leading to the works, or platforms, of a fortification.

APPOINTE, a foot ſoldier, who, for his long ſervice and extraordinary bravery, receives pay above the private ſentinels, and expects to be advanced. This is in France only.

APPOINTMENT, in a military ſenſe, is the pay of the army; likewiſe applied to warlike habiliments, accoutrements, &c.

APPROACHES. All the works are generally ſo called that are carried on towards a place that is beſieged; ſuch as the firſt, ſecond, and third parallels, the trenches, epaulements with and without trenches, redouts, places of arms, ſaps, galleries, and lodgments. See theſe words more particularly at the word FORTIFICATION.

This is the moſt difficult part of a ſiege, and where moſt lives are loſt. The ground is diſputed inch by inch, and neither gained nor maintained without the loſs of men. It is of the utmoſt importance to make your approaches with great caution, and to ſecure them as much as poſſible, that you may not throw away the lives of your ſoldiers. The beſieged neglect nothing to hinder the approaches; the beſiegers do every thing to carry them on; and on this depends the taking or defence of the place.

The trenches being carried to their glacis, you attack and make yourſelf maſter of their covered-way, make a lodgement on the counterſcarp, and a breach by the ſap, or by mines with ſeveral chambers, which blow up their intrenchments and fougades, or ſmall mines, if they have any.

You cover yourſelves with gabions, faſcines, barrels, or ſacks; and if theſe are wanting, you ſink a trench.

You open the counterſcarp by ſaps to make yourſelf maſter of it; but, before you open it, you muſt mine the flanks that defend it. The beſt attack of the place is the face of the baſtion, when by its regularity it permits a regular approach and attacks according to art. If the place be irregular, you muſt not obſerve regular approaches, but proceed according to the irregularity of it; obſerving to humour the ground, which permits you to attack it in ſuch a manner at one place, as would be uſeleſs or dangerous at another; ſo that the engineer who directs the attack ought exactly to know the part he would attack, its proportions, its force, and ſolidity, in the moſt geometrical manner.

APPROACHES, in a more confined ſenſe, ſignify attacks.

Counter APPROACHES, are ſuch trenches as are carried on by the beſieged, againſt thoſe of the beſiegers.

APRON, in *gunnery*, a ſquare plate of lead that covers the vent of a cannon, to keep the charge dry, and the vent clean and open.

Their dimenſions are as follow, viz. for a 42, 32, and a 24 pounder, 15 inches by 13; for an 18, 12, and a 9 pounder, 12 inches by 10; for a 6, $5\frac{1}{4}$, 3, and $1\frac{1}{2}$ pounder, 10 inches by 8. They are tied faſt by two ſtrings of white marline, the length of which, for a 42 to a 12 pounder incluſive, is 18 feet, 9 feet each ſtring; for a 9 to $1\frac{1}{2}$ pounder, 12 feet, 6 feet for each.

AQUEDUCT, a channel to convey water from one place to another. The Romans had aqueducts which extended 100 miles. That of Louis XIV. near Maintenon, which carries the river Bute to Verſailles, is 7000 toiſes long, &c.

ARAIGNEE, in *fortification*. See GALLERY.

ARCH, in *military architecture*, is a vault or concave building, in form of a curve, erected to ſupport ſome heavy ſtructure, or paſſage.

Triumphal ARCH, in *military hiſtory*, is a ſtately gate, generally of a ſemicircular form, adorned with ſculpture, inſcriptions, &c. erected in honour of thoſe heroes who have deſerved a triumph.

ARCHERY, is the art of ſhooting with a bow. Our anceſtors were famous for being the beſt archers in Europe, and moſt of our victories in France were the purchaſe of the long-bow. The ſtatutes made in 33 Hen. VIII. relative to this exerciſe, are worth peruſal, and would afford noble hints towards rendering our militia invincible.

ARCHITECTURE, in a *military ſenſe*, is the art of erecting all kinds of military edifices or buildings, whether for habitation or defence.

Military ARCHITECTURE, inſtructs us in the method of fortifying cities, ſea-ports, camps, building powder magazines, barracks, &c. See FORTIFICATION.

Naval ARCHITECTURE, is the art of building the hull, or body of the ſhip, diſtinct from her machinery and furniture for ſailing; and may properly be comprehended in three principal articles. 1. To give the ſhip ſuch a figure, or outward form, as may be moſt ſuitable to the ſervice for which ſhe is intended. 2. To find the exact ſhape of the pieces of timber neceſſary to compoſe ſuch a fabric. 3. To make convenient apartments for the artillery, ammunition, proviſions and cargo; together with ſuitable accommodations for the officers and men.

ARCHITRAVE, the maſter beam, or chief ſupporter, in any part of a ſubterraneous fortification.

AREA, the ſuperficial content of any rampart, or other work of a fortification.

ARM, in *geography*, denotes a branch of the ſea, or of a river.

ARM is alſo uſed figuratively to denote power.

To ARM, to take arms, to be provided againſt an enemy, or caſualty.

ARMADA, a Spaniſh term, ſignifying a

fleet of men of war, applied particularly to that great one fitted out by the Spaniards, with an intention to conquer this iſland in 1588.

ARMADILLA, a Spaniſh term, ſignifying a ſmall ſquadron.

ARMATURA, in *ancient military hiſtory*, ſignifies the fixed and eſtabliſhed military exerciſe of the Romans, nearly in the ſenſe we uſe the word Exerciſe.

ARMED, in a general ſenſe, denotes ſomething provided with, or carrying arms.

An Armed *body of men*, denotes a military detachment, provided with arms and ammunition, ready for an engagement.

Armed, in the *ſea language*. A croſs-bar-ſhot is ſaid to be armed, when ſome rope-yarn, or the like, is rolled about the end of the iron bar which runneth through the ſhot.

Armed *ſhip*, is a veſſel taken into the government's ſervice, and equipped by them, in time of war, with artillery, ammunition, and warlike inſtruments: it is commanded by an officer who has the rank of maſter and commander in the navy, and upon the ſame eſtabliſhment with ſloops of war, having a lieutenant, maſter, purſer, ſurgeon, &c.

ARMILUSTRIUM, in *Roman antiquity*, a feaſt held among the Roman generals, in which they ſacrificed, armed, to the ſound of trumpets, and other warlike inſtruments.

ARMISTICE, a temporary truce, or ceſſation of arms for a very ſhort ſpace of time only.

ARMORY, a warehouſe of arms, or a place where the military habiliments are kept, to be ready for uſe.

ARMOUR, denotes all ſuch habiliments as ſerve to defend the body from wounds, eſpecially darts, a ſword, a lance, &c. A complete ſuit of armour formerly conſiſted of a helmet, a ſhield, a cuiraſſe, a coat of mail, a gantlet, &c. now almoſt univerſally laid aſide.

ARMOUR-BEARER, he that carries the armour of another.

ARMOURER, a perſon who makes or deals in armour, or arms; alſo a perſon who keeps them clean.

ARMS, in general, all kinds of weapons, whether uſed for offence or defence. In a legal ſenſe, arms may extend to any thing that a man wears for his own defence, or takes in his hand, and uſes in anger, to ſtrike, throw at, or wound another.

Bells of Arms, a kind of tents in the ſhape of a cone, where the company's arms are lodged in the field. They are generally painted with the colour of the facing of the regiment, and the king's arms in front.

Paſs of Arms, a kind of combat, when antiently one or more cavaliers undertook to defend a paſs againſt all attacks.

Place of Arms. See Fortification.

Stand of Arms, a complete ſet of arms for one ſoldier.

Arms, in *artillery*, are the two ends of an axletree. See Axletree, under the word CARRIAGE.

Fire-Arms, are great guns, firelocks, carbines, guns and piſtols; or any other machine diſcharged by inflamed powder.

ARMY, a large number of ſoldiers, conſiſting of artillery, foot, horſe, dragoons, and huſſars or light-horſe, completely armed, and provided with engineers, a train of artillery, ammunition, proviſions, commiſſariate, forage, &c. and under the command of one general, having lieutenant-generals, major-generals, brigadiers, colonels, lieutenant-colonels, majors, captains, and ſubalterns. An army is compoſed of brigades, regiments, battalions, and ſquadrons; and is generally divided into three or more corps, and formed into three lines; the firſt of which is called the front-line, a part of which forms the van-guard; the ſecond, the main body; and the third, the rear-guard, or corps of reſerve. The centre of each line is generally poſſeſſed by the foot; the cavalry form the right and left wings of each line; and ſometimes a ſquadron of horſe is poſted in the intervals between the battalions. When an army is drawn up in order of battle, the horſe are frequently placed at five feet from each other, and the foot at three. In each line the battalions are diſtant from each other about 180 feet, which is nearly equal to the extent of their front; and the ſame holds good of the ſquadrons, which are about 300 feet diſtant, the extent of their own front. Theſe intervals are left for the ſquadrons and battalions of the ſecond line to range themſelves againſt the intervals of the firſt, that both may more readily march thro' thoſe ſpaces to the enemy. The front line is generally about 300 feet from the centre line; and the centre line as much from the rear, or corps of reſerve; that there may be ſufficient room to rally when the ſquadrons or battalions are broken.

A naval or ſea Army, is a number of ſhips of war, equipped and manned with ſailors, mariners, and marines, under the command of an admiral, with the requiſite inferior officers under him.

Flying Army, a ſtrong body of horſe and foot, commanded for the moſt part by a lieutenant-general, which is always in motion, both to cover its own garriſons, and to keep the army in continual alarm. It is alſo uſed for the ground on which ſuch a body of men encamps.

Wings of an ARMY. See WINGS.

ARREARS, in *the army*, is the difference between the full pay and ſubſiſtence of each officer, which is always paid once a year by the agent. See PAY.

ARROW. See FORTIFICATION.

ARSENAL, in a large and well-fortified town, is a large and ſpacious building, in which are depoſited all kinds of arms, and other warlike implements; ſuch as cannon, mortars, howitzers, ſmall arms, and every other kind of warlike engines and inſtruments of death, which ſhould be kept clean, and in good and ſerviceable repair, under the direction of a ſtore-keeper and artiſans.

ARTICLES OF WAR, are thoſe known rules and regulations for the better government of the army in the kingdoms of Great-Britain and Ireland, dominions beyond the ſeas, and foreign parts: they are in number 27, beſides thoſe for the adminiſtration of juſtice, which are 23, and the additional articles for the entry of commiſſions, effects of the dead, artillery, and the American troops.

ARTILLERY, in *a general ſenſe*, ſignifies all ſorts of great guns or cannon, mortars, howitzers, petards, and the like; together with all the apparatus and ſtores thereto belonging, which are not only taken into the field, but likewiſe to ſieges, and made uſe of both to attack and defend fortified places. See ORDNANCE.

ARTILLERY, in *a particular ſenſe*, ſignifies the ſcience of artillery or gunnery, which art includes geometry, trigonometry, conic ſections, laws of motion, mechanics, and projectiles.

Train of ARTILLERY, an unlimited number of pieces of ordnance; ſuch as 24 pounders, 18 pounders, 12, 9, 6, and 3 pounders; mortars from 13 to 8 inches diameter; beſides royals and cohorns; howitzers of every denomination, mounted on their proper carriages and beds, &c. Beſides, to the train belongs a ſufficient quantity of horſes, ſpare carriages, ſpare mortar-beds, block-carriages, limbers, waggons for ammunition and ſtores, ſhells, round and grape ſhot, bullets, powder, cartridges, portfires, intrenching-tools, artificers tools, miners tools, gins, capſtans, forges, ſmall ſtores, laboratory-ſtores, pontoons, pontoon-carriages, with their requiſites; tumbrels, aprons of lead, budge-barrels, chevaux de frize, palliſades, platforms, chandeliers, blinds, drag-ropes, flints, harneſs, powder-meaſures, fuze-engines, fuzes, tents, &c. The train of artillery is, or ſhould be, divided into brigades, to which belong not only the officers of the regiments of artillery, but even the civil-liſt, ſuch as comptrollers, commiſſaries of ſtores, clerks of ſtores, artificers of all denominations, conductors, ſtore-keepers, waggon-maſter, drivers, &c. The increaſe of artillery clearly demonſtrates its great utility; for in the year 1500, an army of 50,000 men had only 40 pieces of cannon in the field; and in the year 1757, the ſame number of troops brought 200 pieces into the field, including mortars and howitzers.

Brigade of ARTILLERY, generally conſiſts of 8 or 10 pieces of cannon, with all the machinery, and officers to conduct them, and all the apparatus thereto belonging.

ARTILLERY-*Park*, is that place appointed by the general of the army, to incamp the train of artillery, apparatus, ammunition, as well as the battalions of the artillery, appointed for its ſervice and defence. The figure of the park of artillery, is that of a paralelogram, unleſs the ſituation of the ground renders another neceſſary.

The park of artillery is generally placed in the centre of the ſecond line of incampment, and ſometimes in the rear line, or corps of reſerve. In both places the muzzles of the guns are in a line with the fronts of the ſerjeants tents of the regiments of artillery and infantry. Some generals chuſe to place the park about 300 paces before the centre of the front line of the army. But let the ſituation be where it will, the manner of forming the park is almoſt every where the ſame, except that ſome artillery officers differ in the diſpoſition of the carriages; others again divide the equipage as well as the guns into brigades, placing the firſt in the front line, the ſecond in the next, and ſo on. However, the beſt, in my humble opinion, and the moſt approved method, is to divide the whole into brigades, placing the guns of the firſt to the right of the front line, and their ammunition behind them, in one or more lines; and the different brigades to be all numbered, with every waggon thereto belonging. Example, 1ſt brigade, front line, No. 1, 2, &c. 1ſt brigade, 2d line, No. 1, 2, &c. 2d brigade, front line, No. 1, 2, &c. and ſo of all the reſt. This method will prevent confuſion in forming and breaking up of the park, as alſo on a march: beſides, according to the numbers, the ſtores therein contained are known.

Plate II. is the plan of ſuch a park of artillery, as is cuſtomary in the Pruſſian army; conſiſting in 80 cannon, 20 mortars, 20 howitzers, 20 pontoons, 3 forges, and 433 waggons, with 2595 horſes, and 649 drivers, ranged as follows.

Firſt line, 20 ſix-pounders, 20 twelve pounders, 20 ſix-pounders; 60 in all.

Second line, 2 ſpare carriages, 18 waggons with balls and cartridges, 4 carriages, 32 waggons with balls, 4 carriages, 17 waggons with balls, 3 carriages; 80 in all.

Third line, 5 ſpare carriages, 33 waggons with balls, 3 ditto with port-fires and matches, 32 ditto with cartridges and grape-ſhot, 6 carriages; in all 79.

Fourth line, 20 howitzers, 40 waggons with ſhells, fuzes fixed, 20 mortars; in all 80.

Fifth line, 4 carriages, 12 powder carts, 2 waggons with howitzer grape-ſhot, 40 ditto with grenades, 18 ditto with muſket-balls; in all 76.

Sixth line, 80 waggons with muſket-cartridges.

Seventh line, 24 waggons with intrenching tools, 20 pontoons with the requiſites for forming bridges, 2 waggons with extraordinaries for ditto, 20 ditto with muſket-cartridges, 4 ditto with artificers tools, 3 forges, 7 ſpare waggons; in all 80. Each carriage takes up 6 feet, and they are placed at the ſame diſtance from each other in the lines, which makes room ſufficient for loading or unloading them. The ſecond line is 90 feet behind the firſt; all the reſt are 60 feet from each other.

Under the term *Artillery-park*, is to be conſidered the method of incampment for the regiments of artillery, and every thing thereto belonging, which is as follows, viz.

Incampment of a regiment of ARTILLERY: they are always incamped, half on the right, and half on the left of the park. The company of bombardiers (when formed into companies, which is in almoſt every nation excepting England) always takes the right of the whole, and the lieutenant-colonels company the left; next to the bombardiers, the colonels, the majors, &c. ſo that the two youngeſt are next but one to the centre or park: the two companies next to the park, are the miners on the right, and the artificers on the left. See PLATE II.

In the rear of, and 30 feet from the park, are incamped the civil liſt, all in one line.

The breadth between the front tent-pole of one company, and that of another, called the ſtreets, are 36 feet each.

	FEET
From the front pole of officers tent of the quarter-guard, or guard of the army, to the centre of the bells of arms of ditto, is	24
To the parade of the quarter-guard	12
To the firſt line of the regimental parade	150
To the centre of the bells of arms	90
From thence to the front poles of ſerjeants tents	12
For pitching 12 tents of artillery, with their proper intervals, at 9 feet each	108
From the rear of companies tents, to the front of the ſubalterns tents	60
From the front of the ſubalterns, to that of the captains	72
From the front of the captains, to that of the field officers	72
From the front of the field officers, to that of the colonels	36
From the front of the colonels, to that of the ſtaff officers	48
From the front of the ſtaff officers, to the front row of batmans tents	54
From thence to the firſt row of pickets for horſes	6
From thence to the ſecond row	36
From thence to the ſecond row of batmans tents	6
From thence to the front of the grand ſuttler's tent	42
From thence to the centre of the kitchens	60
From thence to the front of petit-ſuttler's tents	45
From thence to the centre of the bells of arms of the rear-guard	45
Total depth	978

The army-guard is in the front of the park, oppoſite the alarm-guns, in a line with the artillery quarter-guards that are placed on the right and left of the artillery companies.

The bells of arms front the poles of ſerjeants tents.

The colours are placed in the centre of the front line of guns, in the interval of the two alarm-guns, in a line with the bells of arms of the companies.

The lieutenant-colonels and majors tents front the centres of the ſecond ſtreets from the right and left of the regiment.

The colonel's tent is in a line with the colours and guard of the army, facing the ſame.

The ſtaff-officers front the centres of the ſecond ſtreets, on the right and left of the angles of the park.

The batmans tents front towards their horſes.

The rear-guard front outwards. The front-poles are in a line with the centre of their bells of arms, and each 18 feet diſtant. The parade of the rear-guard is 12 feet from the bells of arms.

In the rear of the rear-guard, and 80 feet diſtance from their parade, the artillery-horſes and drivers tents are placed, in two or more lines, parallel with the line of guns, extending from the right and left of the whole.

It ſometimes happens that a very large train of artillery is in the field, with two or more regiments: then the oldeſt takes the right of the park; the next oldeſt the left, and the youngeſt the centre: then the centre or grand ſtreet is 63 feet broad, oppoſite which the tent of the commanding-officer is placed. In the centre of this ſtreet, the colours are placed in a line with the bells of arms, and the artillery quarter-guard in the front of the colours, at the ſame diſtance as before mentioned. See PLATE II.

Regiment of ARTILLERY. The corps of artillery, with all its dependencies, is, as it were, the general inſtrument of the army, and without it nothing can be done. It is impoſſible to attack fortified places, or to defend them, without artillery; and an army in the field, without, can never make head againſt one well provided with it. For this reaſon it is, that at all times ſovereigns have taken great care to provide proper officers of learning and capacity to govern, repair and keep in order, this eſſential part of military force.

The ſtrength of a regiment of artillery depends upon the choice of the prince, the quantity of troops he maintains, and more eſpecially on the ſituation of the country, number of fortifications, and foreign eſtabliſhments to be defended. It has always been a prevailing cuſtom, to regulate the corps of artillery according to the French method; but, ſince the famous preſent king of Pruſſia has fixed his regiments of artillery on quite another plan, we chuſe here firſt to explain our own method, and afterwards that of the king of Pruſſia, and to let the candid reader judge for himſelf, which method is the beſt.

Engliſh ARTILLERY, in the reign of Edward VI. and about the year 1548, conſiſted in the following eſtabliſhment, viz.

			£.	S.	D.	£.	S.	D.
Maſter of Artillery,	Sir Philip Hoby,	Fee	0	0	0	151	11	8
Lieutenant,	Sir Francis Fleming,	Fee	0	0	0	66	13	4
Surveyor,	Anthony Anthony,	Fee	0	0	0	36	10	0
Clerk,	John Rogers, ...	Fee	0	0	0	12	3	4
		In room of a ſervant	0	0	0	12	3	4
Yeoman,	Thomas Sheventon . . .	Fee	0	0	0	9	2	6
		In room of a ſervant	0	0	0	18	5	0
Maſter Gunner,	Chriſtian Gold, .	Fee	0	1	0	18	5	0
Gun-ſtock Maker,	Symond Turner, .	Fee	0	0	6	9	2	6
Gun-founders	John Owen, .	Fee	0	0	8	12	3	4
	Thomas Owen, .	Fee	0	0	8	12	3	4
Gun-ſmith,	John Anthony .	Fee	0	0	6	9	2	6
Artificer, or Engineer,	John Pudney, .	Fee	0	0	4	6	1	8
Maſter Carpenter,	John Johnſon, .	Fee	0	0	8	12	3	4
109 Gunners, whereof	15 at 12d	a day each. . .	0	15	0	273	15	0
	12 at 8d		0	8	0	146	0	0
	80 at 6d		2	0	0	730	0	0
	2 at 4d		0	0	8	12	3	4
Total charges of the artillery for one year . . .						1547	9	2

In the 109 gunners above mentioned, are included fees to the following perſons, viz.

To the	Clerk, John Rogers,	at	8d	a day.
	Maſter-gunner,		12d	
	Yeoman		12d	
To John Owen, Gun-founder,			12d	

So that only 105 effective gunners remain.

The eſtabliſhment of artillery in the reign of queen Elizabeth, eſpecially in the year 1597, is as follows, viz.

Allowances to officers within one quarter, ending the laſt of March, 1597, viz.

	£.
To Sir George Carew, knight, lieutenant of her Majeſty's ordnance, for his allowance one quarter - - - - - - - -	xviii

To

	£.	s.	
To William Parkeringe, ſurveyor of her majeſty's ordnance, for his like quarter's allowance	xviii		
To Stephen Riddleſden, clerk of her majeſty's ordnance, for his like quarter's allowance,	xvii	xii	
To John Lee, keeper of her majeſty's ſtores, ditto	x		
To George Hogge, and John Linewrayce, clerks of the deliveries, ditto	xiii	xi	iiii
To William Cudner, clerk to Sir George Carew, knight, ditto	iiii	xi	ii

Clerks daily attending in the ſaid office, for three months, viz.

	£.	
Richard Palfreyman,	v	
Edward Parkeringe,	v	
William Scott,	v	
Richard Haynes	v	xxxv
Thomas Lemmon	v	
John Squire	v	
Richard Lentall,	v	

£. vxviii xvii vi

That is £518 17 6 for one quarter's ſalary.

Theſe two laſt accounts are taken from a manuſcript of the late Rev. William Goſtling's, and very obligingly communicated to me by capt. William Goſtling, of the royal artillery.

The eſtabliſhment of artillery in the reign of James I. and in the year 1618, is as follows, viz.

1	General of artillery.	
1	Lieutenant of artillery.	
1	Comptroller.	
1	Commiſſary.	
10	Gentlemen	of artillery.
25	Conductors	
6	Engineers.	
2	Comptrollers of fortifications.	
1	Maſter gunner.	
136	Gunners.	
1	Maſter fire-worker.	
2	Conductors of fire-works.	
2	Battery-maſters.	
1	Petardier.	
1	Maſter carpenter.	
12	Carpenters.	
2	Waggon	makers.
2	Gabion	
2	Harneſs	
1	Cooper.	
2	Farriers.	
1	Surgeon.	
1	Surgeon's mate.	
1	Captain of miners.	
25	Miners.	
1	Captain of pioneers.	
25	Pioneers.	
1	Trench	maſter.
1	Waggon	
1	Carriage	
1	Provoſt.	

In 1628, and probably long before, the artillery had ſundry privileges, from which the reſt of the army were exempt, viz. of having the firſt rank and the beſt quarters; neither could any carriage or waggon preſume to march before theirs, except that belonging to the treaſurer.

In 1705, I find the firſt mention is made of the royal regiment of artillery, being before that time only called the train of artillery. It then conſiſted only of 4 companies, under the command of general Borgard. From that period it has gradually increaſed to 4 battalions, each battalion conſiſting of 10 companies, (2 of them invalids) commanded by a colonel commandant, a lieutenant-colonel and major, who have no companies. Each company in war time generally conſiſts of 100 men, commanded by 1 captain, 1 captain lieutenant, 1 firſt, and 3 ſecond lieutenants. In time of peace the companies are reduced to 50 men each.

When Frederick the ſecond, king of Pruſſia, came to the crown, he found the army in a very good condition, excepting the corps of artillery and engineers, which conſiſted chiefly in mechanicks and artiſans, ſcarcely looked on by the reſt of the army and the officers without commiſſions. His majeſty, knowing how neceſſary it was to have a good corps of artillery and engineers, and how impoſſible this was without having officers learned in every branch of the military mathematics; he immediately draughted all the illiterate officers into the garriſon regiments, ſupplying their places with gentlemen of examined capacity; gave them all commiſſions, rank with the officers of the guards, and an extraordinary pay. This method of proceeding eſtabliſhed the honour-

and reputation of that royal and noble corps, on a very reſpectable footing; induced the nobility and men of rank (provided they had capacity) to engage in thoſe corps ſooner than elſewhere; which has brought it to that ſummit of high renown, they at this time enjoy.

The Pruſſian artillery conſiſts in 12 battalions, 8 for the field, and 4 for garriſon. Each battalion has 12 companies, namely, 1 company of bombardiers, 1 of miners, 1 of artificers, and 9 of artillery. The firſt, or bombardier companies, are compoſed of 1 captain, 2 lieutenants, 3 upper and 6 under fire-workers, 2 ſerjeants, 4 corporals, 2 drummers, and 60 bombardiers. The miners have the ſame commiſſioned officers, with 3 ſerjeants, 6 corporals, 2 drummers, 33 miners, and 33 ſappers. The artificers have the ſame officers and non-commiſſioned officers as the miners, with 30 artificers and 36 pontoneers. All the artillery companies have 3 commiſſioned and 6 non-commiſſioned officers, 2 drummers, and 60 artilleriſts. The colonel, lieutenant-colonel, and major's companies, have each a captain-lieutenant; and each battalion has further, 1 chaplain, 1 auditor, 1 adjutant, 1 quarter-maſter, 1 doctor, 3 ſurgeons, 1 ſerjeant-major, 1 drum-major, 6 muſicians, and 1 provoſt.

March of the ARTILLERY. The marches of the artillery are, of all the operations of war, the moſt delicate; becauſe they muſt not only be directed on the object you have in view, but according to the movements the enemy make. Armies generally march in 3 columns, the centre column of which is the artillery: ſhould the army march in more columns, the artillery and heavy baggage march nevertheleſs in one or more of the centre columns; the ſituation of the enemy determines this. If they are far from the enemy, the baggage and ammunition go before or behind, or are ſent by a particular road; an army in ſuch a caſe cannot march in too many columns. But ſhould the march be towards the enemy, the baggage muſt abſolutely be all in the rear, and the whole artillery form the centre column, except ſome brigades, one of which marches at the head of each column, with guns loaded and burning matches, preceded by a detachment for their ſafety.

Suppoſe the enemy's army in a condition to march towards the heads of your columns: the beſt diſpoſition for the march is in 3 columns only; that of the centre for the artillery; for it is then eaſy to form them in order of battle. Hence it is equally commodious for each brigade of artillery to plant themſelves at the head of the troops, in the places marked for them, in ſuch a manner that the whole diſpoſition being underſtood, and well executed, they may form quickly in order of battle in an open country, and in the preſence of any enemy, without riſquing any ſurprize; by which method the artillery will always be in a condition to act as ſoon as the troops, provided they march in brigades.

Is your march through a country full of defiles, ſome dragoons ſhould march at the head of the columns, followed by a detachment of grenadiers, and a brigade of artillery; cannon being abſolutely neceſſary to obſtruct the enemy's forming into order of battle.

When you decamp in the face of the enemy, you muſt give moſt attention to your rear-guard. On ſuch occaſions, all the baggage, ammunition, proviſions, and artillery, march before the troops; your beſt grenadiers, beſt cavalry, ſome good brigades of infantry, together with ſome brigades of artillery, form the rear-guard. Cannon is of infinite uſe for a rear-guard, when obliged to paſs a defile, or a river; and ſhould be placed at the entry of ſuch defile, on an eminence, if there is one, or on any other place, from whence they can diſcover the ground through which the enemy muſt march to attack the rear-guard.

A detachment of pioneers, with tools, muſt always march at the head of the artillery, and of each column of equipage or baggage.

If the enemy is encamped on the right flanks of the march, the artillery, &c. ſhould march to the left of the troops, and vice verſa. Should the enemy appear in motion, the troops front that way, by wheeling to the right or left by diviſions; and the artillery, which march in a line with the columns, paſs through their intervals, and form at the head of the front line, which is formed of the column who flanked neareſt the enemy, taking care at the ſame time that the baggage be well covered during the action.

Though we have ſaid armies generally march in 3 columns, yet where the country will allow it, it is better to march in a greater number; and let that number be what it will, the artillery muſt form the centre columns.

Line of march of the ARTILLERY. 1. A guard of the army; its ſtrength depends on the commander in chief.

2. The companies of miners (excepting a detachment from each, diſperſed in various places, to mend the roads) with tumbrels of tools, drawn by 2 horſes, aſſiſted by pioneers.

3. The brigades of artillery's front guard, with four light 6 pounders loaded, and matches burning.

4. The kettle-drums by 4 horſes, and 2 trumpeters on horſe-back.

5. The flag-gun, drawn by 12 horſes, and ten 12 pounders more, by 4 horſes each.

6. Twenty waggons with ſtores for the ſaid guns, and 1 ſpare one, by 4 horſes each.

7. All the pontoons, with the waggons thereto belonging.

8. Eight 9 pounders, by 3 horſes each.

9. Fifteen waggons with ſtores for ſaid guns, by 4 horſes each, and 2 ſpare ones.

10. Gins and capſtans, with their proper workmen, 3 waggons, with 2 horſes each.

11. A forge on 4 wheels, and 1 waggon, 4 horſes each.

12. Twelve heavy 24 pounders, by 16 horſes each.

13. Sixteen waggons with ſtores for ditto, and 2 ſpare ones, by 4 horſes each.

14. A waggon with tools, and pioneers to mend the roads.

15. Nine light 24 pounders, by 8 horſes each.

16. Twelve waggons with ſtores for ditto, and 2 ſpare ones, by 4 horſes each.

17. A forge and waggon, by 4 } horſes each
18. Nine 24 pounders, by 8 }

19. Twelve waggons with ſtores for ditto, and 2 ſpare ones.

20. Twelve 12 pounders, by 8 horſes each.

21. Sixteen waggons with ſtores for ditto, and 2 ſpare ones.

22. Sixteen 5.8 inch mortars, by 2 horſes each.

23. Twenty-five waggons with ſtores for ditto, and 2 ſpare ones.

24. Ten 8 inch mortars, by 4 horſes each.

25. Twenty waggons with ſtores for ditto, and 2 ſpare ones.

26. Six 10-inch howitzers, by 6 horſes each.

27. Twenty waggons with ſtores for ditto, and 2 ſpare ones.

28. A waggon with tools, and men to mend the roads.

29. A forge and waggon, by 4 horſes each.

30. Ten 8-inch mortars, by 4 horſes each.

31. Twenty waggons with ſtores for ditto, and a ſpare one.

32. Sixteen 12-inch mortars, by 8 horſes each.

33. Thirty waggons with ſtores for ditto, and 2 ſpare ones.

34. Eight 18-inch ſtone mortars, by 10 horſes each.

35. Sixteen waggons with ſtores for ditto, and a ſpare one.

36. Eight 9-pounders, by 3 horſes each.

37. Sixteen waggons, with ſtores for ditto, and a ſpare one.

38. Twenty 6-pounders, by 2 horſes each.

39. Twenty waggons, with ſtores for ditto, and a ſpare one.

40. Two ſling-waggons, and 2 truck-carriages, 4 horſes each.

41. Twenty 3-pounders, by one horſe each.

42. Ten waggons, with ſtores for ditto, and a ſpare one.

43. A waggon, with tools, &c.

44. A forge and waggon, by 4 horſes each.

45. Twelve 2 and 1-pounders, by 1 horſe each.

46. Six waggons, with ſtores for ditto.

47. Sixteen 6-pounders, by 2 horſes each.

48. Ten waggons, with ſtores for ditto.

49. Twenty ſpare carriages, for various calibres.

50. Eighteen ditto.

51. Fifty ſpare limbers.

52. Ten 18-pounders, by 6 horſes each.

53. Twenty waggons, with ſtores for ditto, and 2 ſpare ones.

54. Twenty waggons, with ammunition and ſtores.

55. Two 12-pounders, by 4 horſes each.

56. Four waggons, with ſtores for ditto.

57. Fifty waggons, with ſtores.

58. A waggon, with tools, and men to mend the roads.

59. A forge and waggon, by 4 horſes each.

60. A hundred waggons, with ſtores, and 4 ſpare ones.

61. Four 2 and 1-pounders, by 1 horſe each.

62. A hundred waggons, with ſtores, and 3 ſpare ones.

63. Two hundred waggons, and 2 ſpare ones.

64. Two hundred and fourteen waggons belonging to the artillery baggage; ſome with 4, 3, and 2 horſes each.

65. The artillery rear-guard.

66. The rear-guard from the army.

Officers of ARTILLERY. The commander in chief of the artillery is one of the moſt laborious employments, both in war and peace, requiring the greateſt ability, application, and experience. The officers in general ſhould be great mathematicians and engineers, to know all the powers of artillery, the attack and defence of fortified places; together with every thing belonging to that very important corps.

Artillery *Company*, a band of infantry, conſiſting of 600 men, making part of the militia, or city guard of London.

ASCENT. See Gunnery.

ASSAULT, a furious effort to carry a fortified poſt, camp, or fortreſs, where the aſſailants do not ſcreen themſelves by any works. While an aſſault during a ſiege continues, the batteries ceaſe, for fear of killing their own men. An aſſault is ſometimes made by the regiments that guard the trenches of a ſiege, ſuſtained by detachments from the army.

To give an Assault, is to attack any poſt, &c.

To repulſe an Assault, to cauſe the aſſailants to retreat, to beat them back.

To carry by Assault, to gain a poſt by ſtorm, &c.

ASSEMBLET, the ſecond beating of a drum before a march; at which the army ſtrike their tents, roll them up, and ſtand to arms. See Drum.

ASTRAGAL. See Cannon.

ATTACK, a general aſſault, or onſet, that is given to gain a poſt, or break a body of troops.

Attack *of a ſiege*, is a furious aſſault made by the beſiegers by means of trenches, galleries, ſaps, breaches, or mines, &c. by ſtorming any part of the front attack. Sometimes two attacks are carried on at the ſame time, between which a communication muſt be made. See Siege.

Falſe Attacks, are never carried on with that vigour and briſkneſs that the others are the deſign of them being to favour the true attack, by amuſing the enemy, obliging the garriſon to a greater duty in dividing their forces, that the true attack may be more ſucceſsful.

Regular Attack, is that which is carried on in form, according to the rules of art. See Siege.

To Attack *in front or flank*, in fortification, is meant to attack the ſalient angle, or both ſides of the baſtion; but when meant to attack a body of men, is a phraſe well known.

AVANT-FOSSE. See Fortification.

AVENUE, in fortification, is any kind of opening or inlet into a fort, baſtion, or out-work.

AUGERS. See Mining.

AUGMENT, or *Augmentation*, in a military ſenſe, implies advancement of poſts, augmentation of troops, &c.

AXLE-TREE { of a carriage.
bar.
bolts.
hoops.
ſtays. } See *Carriages.*

B

BACULE, in *fortification*, implies a kind of port-cullis or gate, made like a pit-fall, with a counterpoiſe, and ſupported by two ſtrong pieces of timber. It is uſually placed before the corps de garde, not far from the great gate of the place.

BAGGAGE, in *military affairs*, ſignifies the clothes, tents, utenſils of divers ſorts, and proviſions, &c. belonging to an army.

Baggage-*Waggons.* See Waggons.

BAGONET. See Bayonet.

BAGPIPE, the name of a well-known warlike inſtrument, of the wind kind, greatly uſed by the Scotch regiments, and ſometimes by the Iriſh. Bagpipes are ſuppoſed to be introduced by the Danes; but I am of opinion they are much older, as there is in Rome a moſt beautiful baſs-relievo, a Grecian ſculpture of the higheſt antiquity, of a bag-piper playing on his inſtrument exactly like a modern highlander. The Greeks had their Ασκαυλης, or inſtrument compoſed of a *pipe* and *blown-up ſkin.* The Romans, in all probability, borrowed it from them, who ſtill uſe it under the names of *piva* and *cornu-muſa.* The Bagpipe has been a favourite inſtrument of the Scots, and has two varieties: the one with long pipes, and ſounded with the mouth; the other with ſhort pipes, played on with the fingers: the firſt is the loudeſt and moſt ear-piercing of all muſic, is the genuine highland pipe, and ſuited well the warlike genius of that people, rouzed their courage to battle, alarmed them when ſecure, and collected them when ſcattered; ſolaced them in their long and painful marches, and in times of peace kept up the memory of the gallantry of their anceſtors, by tunes compoſed after ſignal victories.

BAGS, in military employments, are uſed on many occaſions: as,

Sand-Bags, generally 16 inches diameter, and 30 high, filled with earth or ſand to repair breaches, and the embraſures of batteries, when damaged by the enemies fire, or by the blaſt of the guns. Sometimes they are made leſs, and placed three together, upon the parapets, for the men to fire through.

Earth-Bags, containing about a cubical foot of earth, uſed to raiſe a parapet in haſte, or repair one that is beaten down. They are only uſed when the ground is rocky, and not affording earth to carry on the approaches.

BALL, in *the military art*, comprehends all ſorts of balls and bullets for fire-arms, from the cannon to the piſtol.

Cannon-Balls are of iron; muſket and

piſtol-balls are of lead. Cannon-balls are always diſtinguiſhed by their reſpective calibres, thus,

A 42	pound ball, the diameter of which is	6,684 inches
32		6,105
24		5,547
18		5,040
12		4,403
9		4,000
6		3,498
3		2,775
2		2,423
1		1,923

Fire-BALLS, *Light*-BALLS, of which there are various ſorts, and for various purpoſes. Their compoſition is mealed powder 2, ſaltpetre 1½, ſulphur 1, roſin 1, turpentine 2½. Sometimes they are made of an iron ſhell, ſometimes a ſtone, filled and covered with various coats of the above compoſition, 'till of a proper ſize; letting the laſt coat be of grained powder. But the beſt ſort, in my opinion, is to take thick brown paper, and make a ſhell the ſize of the mortar, and fill it with a compoſition of an equal quantity of ſulphur, pitch, roſin, and mealed powder; which being well mixed, and put in warm, will give a clear fire, and burn a conſiderable time.

When they are intended to ſet fire to magazines, buildings, &c. the compoſition muſt be mealed powder 10, ſaltpetre 2, ſulphur 4, and roſin 1; or rather mealed powder 48, ſaltpetre 32, ſulphur 16, roſin 4, ſteel or iron filings 2, fir-tree ſaw-duſt boiled in ſaltpetre ley 2, birch-wood charcoal 1, well rammed into a ſhell for that purpoſe, having various holes filled with ſmall barrels, loaded with muſket-balls; and laſtly the whole emerged in melted pitch, roſin and turpentine oil.

Smoke-BALLS are prepared as above, with this difference, of 5 to 1 of pitch, roſin and ſaw-duſt. This compoſition is put into ſhells made for that purpoſe, having 4 holes to let out the ſmoke: they are thrown out of mortars, and continue to ſmoke from 25 to 30 minutes.

Stink-BALLS are prepared by a compoſition of mealed powder, roſin, ſaltpetre, pitch, ſulphur, raſped horses and aſſes hoofs, burnt in the fire, aſſa-fœtida, ſeraphim-gum or ferula, and bug or ſtinking herbs, made up into balls, as mentioned at *Light*-BALLS, agreeable to the ſize of the mortar you intend to throw them out of.

Poiſoned-BALLS. I am not ſure whether ever they have been uſed in Europe, but the Indians and Africans have always been very ingenious at poiſoning ſeveral ſorts of warlike ſtores and inſtruments. Their compoſition is mealed powder 4, pitch 6, roſin 3, ſulphur 5, aſſa-fœtida 8, extract of toads poiſon 12, other poiſonous ſubſtances 12, made into balls as above directed.

Red-hot BALLS are fired out of mortars, howitzers, or cannon. Uſe which you will, the ball muſt be made red-hot, which is done upon a large coal fire in a ſquare hole made in the ground, 6 feet every way, and 4 or 5 feet deep. Some make the fire under an iron grate, on which the ſhell or ball is laid; but the beſt way is to put the ball into the middle of a clear burning fire, and when red-hot, all the fiery particles muſt be ſwept off. Whatever you uſe to throw the red-hot ball out of, muſt be elevated according to the diſtance you intend it ſhall range, and the charge of powder put into a flannel cartridge, and a good wad upon that; then a piece of wood of the exact diameter of the piece, and about 3½ inches thick, to prevent the ball from ſetting fire to the powder; then place the ball on the edge of the mortar, &c. with an inſtrument for that purpoſe, and let it roll of itſelf againſt the wood, and inſtantly fire it off. Should there be a ditch or parallel before ſuch a battery, with ſoldiers, the wood muſt not be uſed, as the blaſt of powder will break it to pieces, and its own elaſticity prevent it from flying far; it would in that caſe either kill or wound your own people. For this deficiency the wad muſt be double.

Chain-BALLS are two balls linked together by a chain of 8 or 10 inches long, and I have even ſeen ſome with a chain of 3 or 4 feet long; they are uſed to deſtroy the paliſadoes, wooden bridges, and chevaux-de-friezes of a fortification. They are alſo very deſtructive to the rigging of a ſhip.

Stang-BALLS are by ſome called balls of two heads; they are ſometimes made of two half-balls joined together by a bar of iron from 8 to 14 inches long; they are ſometimes made of two entire balls: they are for the ſame purpoſe as the before-mentioned.

Anchor-BALLS are made in the ſame way as the light-balls, and filled with the ſame compoſition, only with this addition, that theſe are made with an iron bar of ⅔ of the ball's diameter in length, and 3 or 4 inches ſquare. One half is fixed within the ball, and the other half remains without; the end of the out half is made with a grapple-hook. Very uſeful to ſet fire to wooden bridges, or any thing made of wood, or even the rigging of ſhips, &c. for the pile-end being the heavieſt, flies foremoſt, and wherever it touches, faſtens, and ſets all on fire about it.

Meſſage-BALLS. See SHELLS.

BALLIUM, in *ancient military hiſtory*. In towns the appellation of ballium was given to a work fenced with palliſades, and ſometimes maſonry, covering the ſuburbs; but in caſtles it was the ſpace immediately within the outer wall.

BAN, a ſort of proclamation made at the head of a body of troops, or in the ſeveral quarters or cantonments of an army, by ſound of trumpet, or beat of drum; either for obſerving of martial diſcipline, or for declaring a new officer, or puniſhing a ſoldier, or the like. At preſent ſuch kind of proclamations are given out in the written orders of the day.

BANDOLEERS, in *ancient military hiſtory*, a large leathern belt worn over the right ſhoulder, and hanging under the left arm, to carry ſome kind of warlike weapon.

BANDOLIERS, are little wooden caſes covered with leather, of which every muſketeer uſed to wear 12 hanging on a ſhoulder-belt; each of them contained the charge of powder for a muſket. They are now no more in uſe, but are ſtill to be ſeen in the ſmall-armory in the Tower.

BANDROLLS. See CAMP COLOURS.

BANDS, properly bodies of foot, though almoſt out of date.

Trained-BANDS. In England the militia are generally ſo called.

BAND *of Penſioners*, a company of gentlemen ſo called, who attend the King's perſon upon all ſolemn occaſions. They are 120 in number, and receive a yearly allowance of 100l.

BAND is alſo the denomination of a military order in Spain, inſtituted by Alphonſus XI. king of Caſtile, for the younger ſons of the nobility, who, before their admiſſion, muſt ſerve 10 years, at leaſt, either in the army or at war; and are bound to take up arms in defence of the Catholic faith, againſt the infidels.

BANQUETTE. See FORTIFICATION.

BANNERS, the ordnance-flag fixed on the fore part of the drum-major's kettle-drum carriage of the royal artillery.

BARBACAN, or *Barbican*, a watch-tower, for the purpoſe of deſcrying an enemy at a great diſtance: it alſo implies an outer defence, or ſort of ancient fortification to a city or caſtle, uſed eſpecially as a fence to the city, or walls; alſo an aperture made in the walls of a fortreſs to fire through upon the enemy. It is ſometimes uſed to denote a fort at the entrance of a bridge, or the outlet of a city, having a double wall with towers.

BARBICANAGE, money given to the maintenance of a Barbican.

BARBE. See BARBET.

BARBETS, are peaſants ſubject to the king of Sardinia, who abandon their dwellings, when the enemy has taken poſſeſſion of them. The king forms them into bodies, who defend the Alps, being part of his dominions.

BARBET-*Battery*. See BATTERY.

BARM, or *Berm*. See FORTIFICATION.

BARS are of ſundry ſorts, as

Sweep }
Croſs } BARS. See TUMBRIL.

Fore }
Hind } *Croſs*-BARS. See POWDER-CART.
Under }

Shaft } BARS. See { WAGGON.
Dowel } { MORTAR BED.

BARRACKS, or *Baracks*, are places erected for both officers and men to lodge in; they are built different ways, according to their different ſituations. When there is ſufficient room to make a large ſquare, ſurrounded with buildings, they are very convenient, becauſe the ſoldiers are eaſily confined to their quarters, and the rooms being contiguous, orders are executed with privacy and expedition; and the ſoldiers have not the leaſt connection with the inhabitants of the place, which prevents quarrels and riots. The barracks at Woolwich are 16 feet ſquare, and 3 beds in each room to hold 6 ſoldiers only, which is not ſufficient. They would be much better if they were 20 feet long, and 18 broad, and hold 4 beds. They are ſometimes built 2 or 3 ſtories high.

BARRICADE. To barricade is to fortify with trees, or branches of trees, cut down for that purpoſe, the bruſhy ends towards the enemy. Carts, waggons, &c. are ſometimes made uſe of for the ſame purpoſe, viz. to keep back both horſe and foot for ſome time.

BARRELS, in military affairs, are of various kinds.

Fire-BARRELS are of different ſorts: ſome are mounted on wheels, filled with compoſition and intermixed with loaded grenades, and the outſide full of ſharp ſpikes: ſome are placed under ground, which have the effect of ſmall mines: they are uſed to roll down a breach, to prevent the enemy's entrance.——Compoſition, corned powder 30 lb. Swediſh pitch 12, ſaltpetre 6, and tallow 3.

Thundering-BARRELS are for the ſame purpoſe, filled with various kinds of combuſtibles, intermixed with ſmall ſhells, grenades, and other fireworks.——Not uſed now.

Powder-BARRELS are about 16 inches diameter, and 30 or 32 inches long, holding 100 pounds of powder.

Budge-BARRELS, hold from 40 to 60 pounds of powder: at one end is fixed a leather bag with braſs nails: they are uſed in actual ſervice on the batteries, to keep the powder from firing by accident, for loading the guns and mortars.

BARRIER, in *fortification*, a kind of fence compoſed of ſtakes, and tranſums, as overthwart rafters, erected to defend the entrance of a paſſage, retrenchment, or the like. In the middle of the barrier is a moveable bar of wood, which is opened and ſhut at pleaſure. It alſo implies a gate made of wooden bars, about 5 feet long, perpendicular to the horizon, and kept together by two long bars going acroſs, and another croſſing diagonally: they are uſed to ſtop the cut made through the eſplanade before the gate of a town.

BARRIER-*Towns*, in *military hiſtory*, are Menin, Dendermond, Ypres, Tournay, Mons, Namur, and Maſtricht. Theſe towns are garriſoned half by French or Imperial, and half by Dutch troops.

BASE, or *Baſis*, in *fortification*, the exterior part or ſide of a polygon, or that imaginary line which is drawn from the flanked angle of a baſtion to the angle oppoſite to it.

BASE ſignifies alſo the level line on which any work ſtands that is even with the ground, or other work on which it is erected. Hence the baſe of a parapet is the rampart.

BASE, an ancient word for the ſmalleſt cannon. See CANNON.

BASE-*Ring*. See CANNON.

BASILISK, an ancient name given to a 48 pounder. See CANNON.

BASIS, the ſame as BASE.

BASKETS, in *military affairs*, are ſimple baſkets, frequently uſed in ſieges. They are filled with earth, and placed on the parapet of the trench, or any other part. They are generally about a foot and a half in diameter at the top, and eight inches at the bottom, and a foot and a half in height; ſo that, being placed on the parapet, a kind of embraſures are formed at the bottom, through which the ſoldiers fire, without being expoſed to the ſhot of the enemy.

BASTION. See FORTIFICATION.

BATARDEAU, in *fortification*, is a maſſive perpendicular pile of maſonry, whoſe length is equal to the breadth of the ditch, inundation, or any part of a fortification where the water cannot be kept in without the raiſing of theſe ſorts of works, which are deſcribed either on the capitals prolonged of the baſtions or half-moons, or upon their faces. In thickneſs it is from 15 to 18 feet, that it may be able to withſtand the violence of the enemy's batteries. Its height depends upon the depth of the ditch, and upon the height of the water that is neceſſary to be kept up for an inundation; but the top of the building muſt always be under the cover of the parapet of the covert-way, ſo as not to be expoſed to the enemy's view. In the middle of its length is raiſed a maſſive cylindrical turret, whoſe height exceeds the batardeau 6 feet.

Knights of the BATH, an Engliſh military order of uncertain original. Some writers ſay it was inſtituted in the Saxon times; ſome will have it to have been founded by Richard II. and others by Henry IV. nor is the occaſion that gave riſe to their order better known. Some ſay it aroſe from the cuſtom which formerly prevailed of bathing, before they received the golden ſpurs. Others ſay that Henry IV. being in the bath, was told by a Knight, that two widows were come to demand juſtice of him; when leaping out of the bath, he cried, "It was his duty to prefer the doing of juſtice "to his ſubjects to the pleaſures of the bath;" and in memory of this tranſaction the Knights of the Bath were created. Camden however inſiſts, that this was only the reſtoration of the order, which was in that prince's reign almoſt aboliſhed: But however that be, the order was revived under George I. by a ſolemn creation of a conſiderable number of Knights. They wear a red ribbon, and their motto is, *Tria juncta in uno*, alluding to the three cardinal virtues which every Knight ought to poſſeſs.

BATMEN are ſervants hired in war time to take care of the horſes belonging to the train of artillery, bakery, baggage, &c. They generally wear the king's livery during their ſervice.

BATTALIA, in *military affairs*, implies an army or conſiderable detachment of troops drawn up in order of battle, or in any other proper form to attack the enemy. See BATTLE.

BATTALION, or *Batallion*, an undetermined body of infantry in regard to number, generally from 500 to 800 men. In our foot guards, the firſt regiment conſiſts of 3 battalions, and the ſecond and third of 2 each. The royal regiment of artillery conſiſts of 4 battalions. Sometimes regiments conſiſt of but 1 battalion; but if more numerous, are divided into ſeveral battalions, according to their ſtrength; ſo that every one may come within the numbers mentioned. A battalion in one of our marching regiments conſiſts of 603 men, officers and non-commiſſioned included. When there are companies of ſeveral regiments in a garriſon to form a battalion, thoſe of the eldeſt regiment poſt themſelves on the right, thoſe of the ſecond on the left, and ſo on until the youngeſt fall into the centre. The officers take their poſts before their companies, from the right and left, according to ſeniority. Each battalion is divided into 4 diviſions, and each diviſion forms 2 platoons. The companies of grenadiers being unequal in all battalions, their poſt ſhould be regulated by the commanding officer. See REGIMENT.

Triangular BATTALION, in *ancient military hiſtory*, a body of troops ranged in the form of a triangle, in which the ranks exceed each other by an equal number of men: if the firſt rank conſiſts of one man only, and the difference between the ranks is only one, then its form is that of an equilateral triangle; and when the difference between the ranks is more than one, its form may then be an iſoſceles, or ſcalene triangle. This method is now laid aſide.

BATTERING, in *military affairs*, implies the firing with heavy artillery on ſome fortification or ſtrong poſt poſſeſſed by an enemy, in order to demoliſh the works.

BATTERING-*Pieces* are large pieces of cannon, though they now never exceed a 24 pounder, uſed in battering a fortified town or poſt.

BATTERING-*Train*, a train of artillery uſed ſolely for beſieging a ſtrong place, incluſive of mortars and howitzers: all heavy 24, 18, and 12 pounders, come under this denomination; as likewiſe the 10 and 8-inch mortars and howitzers.

BATTERING-*Ram*. See the article RAM.

BATTERY, in *military affairs*, implies any place where cannon or mortars are mounted, either to attack the forces of the enemy, or batter a fortification: hence batteries have various names, agreeable to the purpoſes they are deſigned for.

Gun-BATTERY, is a defence made of earth faced with green ſods or faſcines, and ſometimes made of gabions filled with earth: it conſiſts of a *breaſt-work, parapet*, or *epaulement*, of 18 or 20 feet thick at top, and of 22 or 24 at the foundation; of a ditch 12 feet broad at the bottom, and 18 at the top, and 7 feet deep. They muſt be 7½ feet high. The embraſures are 2 feet wide within, and 9 without, ſloping a little downwards, to depreſs the metal on occaſion. The diſtance from the centre of one embraſure to that of the other is 18 feet; that is, the guns are placed at 18 feet diſtance from each other; conſequently the *merlins* (or that part of ſolid earth between the embraſures) are 16 feet within, and 7 without. The *genouillieres* (or part of the parapet which covers the carriage of the gun) are generally made 2½ feet high from the platform to the opening of the embraſures; though this height ought to be regulated according to the ſemi-diameter of the wheels of the carriage, or the nature of the gun. The *platforms* are a kind of wooden floors, made to prevent the cannon from ſinking into the ground, and to render the working of the guns more eaſy; and are, ſtrictly ſpeaking, a part of the battery. They are compoſed of 5 ſleepers, or joiſts of wood, laid lengthways, the whole length of the intended platform; and to keep them firm in their places, ſtakes muſt be driven into the ground on each ſide: theſe ſleepers are then covered with ſound thick planks, laid parallel to the parapet; and at the lower end of the platform, next to the parapet, a piece of timber 6 inches ſquare, called a *hurter*, is placed, to prevent the wheels from damaging the parapet. Platforms are generally made 18 feet long, 15 feet broad behind, and 9 before, with a ſlope of about 9 or 10 inches to prevent the guns from recoiling too much, and for bringing them more eaſily forward when loaded. The dimenſions of the platforms, ſleepers, planks, hurters, and nails, ought to be regulated according to the nature of the pieces that are to be mounted. See Plate III. fig. 1.

The powder magazines to ſerve the batteries ought to be at a convenient diſtance from the ſame, as alſo from each other; the large one, at leaſt 55 feet in the rear of the battery, and the ſmall ones about 25. Sometimes the large magazines are made either to the right or left of the battery, in order to deceive the enemy; to be 5 feet under ground; the ſides and roof to be well ſecured with boards, and covered with earth, clay, or ſomething of a ſimilar ſubſtance, to prevent the powder from being fired: they are guarded by centinels, ſword in hand. The balls are piled in readineſs beſide the merlins, between the embraſures.

The officers of the artillery ought always to conſtruct their own batteries and platforms, and not the engineers, as is practiſed in England; for certainly none can be ſo good judges of thoſe things as the artillery officers, whoſe daily practice it is; conſequently they are the propereſt people to direct the ſituation and making of batteries on all occaſions.

Mortar-BATTERY. Theſe kinds of batteries differ from gun-batteries, only in having no embraſures. They conſiſt in a parapet of 18 or 20 feet thick, 7½ high in front, and 6 in the rear; of a berm 2½ or 3 feet broad, according to the quality of the earth; of a ditch 24 feet broad at the top, and 20 at the bottom. The beds muſt be 9 feet long, 6 broad, 8 from each other, and 5 feet from the parapet: they are not to be ſloping like the gun-platforms, but exactly horizontal. The inſides of theſe batteries are ſometimes ſunk 2 or 3 feet into the ground, by which they are much ſooner made than thoſe of cannon. The powder magazines and piles of ſhells are placed as is mentioned in the art. GUN-BATTERY. See Pl. III. fig. 2.

Ricochet-BATTERY, ſo called by its inventor M. Vauban, and firſt uſed at the ſiege of Aeth in 1697. It is a method of firing with a very ſmall quantity of powder, and a little elevation, ſo as juſt to fire over the parapet; and then the ſhot will roll along the oppoſite rampart, diſmounting the cannon, and driving or deſtroying the troops. At a ſiege they are generally placed at about 300 feet before the firſt parallel, perpendicular to the faces produced, which they are to enfilade. Ricochet practice is not confined to cannon alone; ſmall mortars and howitzers may effectually be uſed for the ſame purpoſe. They are of ſingular uſe in the day of battle, to enfilade the enemy's ranks; for when they perceive the ſhells rolling and bouncing about with their fuzes burning, expecting them to burſt every moment, the braveſt among them will hardly have courage to wait their approach and the fatal event.

Horizontal BATTERIES are ſuch as have only a parapet and ditch; the platform being only the ſurface of the horizon made level.

Breach or *Sunk* BATTERIES are ſuch as are ſunk upon the glacis, with a deſign to make an acceſſible breach in the faces or ſalient angles of the baſtion and ravelin.

Croſs-BATTERIES are ſuch as play athwart each other againſt the ſame object, forming an angle there; whence greater deſtruction follows, becauſe what one ſhot ſhakes, the other beats down.

Oblique-BATTERIES, or *Batteries en Echarpé*, are thoſe which play on any work obliquely, making an obtuſe angle with the line of range, after ſtriking the object.

Enfilading-BATTERIES are thoſe that ſweep or ſcour the whole length of a ſtrait line, or the face or flank of any work.

Sweeping-BATTERIES. See *Enfilading*-BATTERIES.

Redan-BATTERIES are ſuch as flank each other at the ſalient and rentrant angles of a fortification.

Direct-BATTERIES are thoſe ſituated oppoſite the place intended to be battered, ſo that the balls ſtrike the works nearly at right angles.

Reverſe-BATTERIES are thoſe which play on the rear of the troops appointed to defend the place.

Glancing-BATTERIES are ſuch whoſe ſhot ſtrike the object at an angle of about 20°, after which the ball glances from the object, and recoils to ſome adjacent parts.

Joint-BATTERIES, *Comerade*-BATTERIES, } when ſeveral guns fire on the ſame object at the ſame time. When 10 guns are fired at once, their effect will be much greater than when fired ſeparately.

Sunk-BATTERIES are thoſe whoſe platforms are ſunk beneath the level of the field, the ground ſerving for the parapet; and in it the embraſures are made. This often happens in mortar, but ſeldom in gun-batteries. BATTERY ſometimes ſignifies the guns themſelves placed in a battery.

BATTERY-*Planks* are thoſe planks or boards uſed in making platforms.

BATTERY-*Boxes* are ſquare cheſts or boxes, filled with earth or dung; uſed in making batteries, where gabions and earth are not to be had. They muſt not be too large, but of a ſize that is governable.

BATTERY-*Nails* are wooden pins made of the tougheſt wood, with which the planks that cover the platforms are nailed. Iron nails might ſtrike fire againſt the iron-work of the wheels, in recoiling, &c. and be dangerous.

Faſcine-BATTERIES, *Gabion*-BATTERIES, } are batteries made of thoſe machines, where ſods are ſcarce, and the earth very looſe or ſandy.

Number of men, tools, pickets, and planks for making BATTERIES, *from 2 to 20 pieces of cannon, in one night.*

N°. of guns	Length of the battery	Men to make the		Tools	Faſcines of			Pickets	Mallets	Hand-bills	Platforms			Bavins
		Battery	faſcines		10 feet	8 feet	6 feet				Planks	Sleepers	Pickets	
2	40	50	15	70	70	48	16	590	10	12	36	10	68	0
4	58	70	25	100	120	76	32	1000	18	16	72	20	128	100
6	76	90	35	130	170	104	48	1410	26	20	108	30	192	150
8	94	110	45	160	220	132	64	1820	34	24	144	40	256	200
10	112	130	55	190	270	160	80	2230	42	28	180	50	320	250
12	130	150	65	220	320	188	96	2640	50	32	216	60	384	300
14	148	170	75	250	370	216	112	3050	58	36	252	70	448	350
16	166	190	85	280	420	244	128	3460	66	40	288	80	512	400
18	184	210	95	310	470	272	144	3870	74	44	324	90	576	450
20	202	230	105	340	520	300	160	4280	82	48	360	100	640	500

Battery-*Maſter*, whoſe duty formerly it was to raiſe the batteries. This office is now ſuppreſſed in England.

Battering-*Pieces*,
Battering-*Train*, } are thoſe guns made uſe of at a ſiege to make breaches in the works. It is judged by all nations that no leſs than 24 or 18 pounders are proper for that uſe. Formerly much larger calibres were uſed, but, as they were ſo long and heavy, became very troubleſome to tranſport and manage; are now entirely rejected.

BATTEURS *d'Eſtrade*. See Scouts.

BATTLE, implies an action, where the forces of two armies are engaged; and is of two kinds, *general* and *particular*; general where the whole army is engaged, and particular where only a part is in action; but as they only differ in numbers, the methods are nearly alike.

The moſt remarkable on Engliſh record are the

1016. Battle of Aſhdown, between Canute and Edmund.

1066. Battle of Haſtings, where king Harold was ſlain.

1214.	Battle of	Bovines, 25 July.
1217.		Lincoln, 19 May.
1264.		Lewis, 14 May.
1265.		Eveſham, 4 Aug.
1314.		Bannockburn, 25 June.
1333.		Haldon-Hill, 19 July.
1346.		Creſſy, 26 Aug.

Battle of Durham, when David, king of Scots, was taken priſoner, 17 Oct.

1356. Battle of Poictiers, when the king of France and his ſon were taken priſoners, 19 Sept.

1388. Battle of Otterburn, between Hotſpur and earl Douglas, 31 July.

1403.	Battle of	Shrewſbury, 12 July.
1415.		Agincourt, 25 Oct.
1421.		Beaugé, 3 April.
1423.		Crevant, June.
1424.		Ferneuil, 27 Aug.
1429.		Herrings, 12 Feb.
1455.		St. Alban's, 22 May.
145[illegible]		Bloreheath, 23 Sept.
1460.		Northampton, 10 July.
		Wakefield, 24 Dec.
1461.		Touton, 29 March.
1464.		Hexham, 15 May.
1469.		Banbury, 26 July.
1470.		Stamford, March.
1471.		Barnet, 14 April.
		Tewkeſbury, 4 May.
1485.		Boſworth, 22 Aug.

1487.	Battle of	Stoke, 6 June.
1497.		Blackheath, 22 June.

1513. Battle of Flouden, 9 Sept. when James IV. king of Scots, was killed.

1542.	Battle of	Solway, 24 Nov.
1547.		Pinkey, 10 Sept.
1557.		St. Quintin, 10 Aug.
1642.		Edgehill, 24 Oct.
1643.		Shatton, 16 May.
		Lanſdown, 5 July.
		Roundawaydown, 13 July
		Newbury, 20 Sept.
1644.		Marſton-moor, 2 July.
1641.		Naſeby, June.
1650.		Dunbar, 3 Sept.
1651.		Worceſter, 3 Sept.
1679.		Bothwell-bridge, 22 June
1690.		Boyne, 1 July.
1691.		Aughrim, 22 July.
1662.		Steinkirk.
1704.		Blenheim, 13 Aug.
1706.		Ramillies, on Whitſunday
1708.		Oudenard, 30 June.
		Wynendale, 28 Sept.
1709.		Malplaquet, 11 Sept.
		Blaregmes, 14 Sept.
1715.		Dumblain, 12 Nov.
1743.		Dettingen, 26 June.
1744.		Fontenoy, 30 Apr.
1745.		Preſton-pans. 21 Sept.
1746.		Falkerk, 17 Jan.
		Culloden, 16 April.
1747.		Laffeld, 20 July.
1756.		Loboſitz, 1 Oct.
1757.		Roſbach, 5 Nov.
		Reichenberg, 21 April.
		Gros Jegerndorff, 30 Aug.
		Breſlau, 22 Nov.
		Liſſa, 5 Dec.
		Haſtenbeck, 26 July.
		Kolin, 13 June.
		Prague, 6 May.
1758.		Sanderſhauſen, 23 July.
		Crevelt, 23 June.
		Meer, 5 Aug.
		Zorndorff, 25 Aug.
		Sanderſhagen, 10 Oct.
		Munden, 11 Oct.
		Huchkerken, 14 Oct.
1759.		Cunnerſdorf, 12 Aug.
		Bergen, 13 April.
		Zullichau, 23 July.
		Coefeld, 1 Aug.
		Minden, 1 Aug.
		Torgau, 8 Sept.
		Pretſch, 29 Oct.

1759.		Abraham, 13 Sept.
		Moxen, 20 and 21 Nov.
1760.		Coſdorff, 20 Feb.
		Quebec, 28 April.
		Grabenſteyn, 4 June
		Corbach, 24 June.
		Emſdorff, 9 July.
		Warburg, 31 July.
		Strehlen, 2 Aug.
		Leignitz, 15 Aug.
	Battle of	Torgau, 2 Nov.
1761.		Langenſaltze, 15 Feb.
		Grünberg, 21 March.
		Vellinghauſen, 16 July.
		Kirkdenckern, 15 July.
		Einbeck, 24 Aug.
1762.		Dobeln, 12 May.
		Wilhelmſtahl, 24 June.
		Fulda, 23 July.
		Friedberg, 30 Aug.
		Freyberg, 10 and 29 Oct.
1775.		Bunker's-hill, 17 June.

There is no action in war more brilliant than that of battles. Their ſucceſs ſometimes decides the fate of kingdoms. It is by this action a general acquires his reputation. It is in battle that his valour, his force of genius, and his prudence, appear in their full extent; and where eſpecially he has occaſion for that firmneſs of mind, without which the moſt able general will hardly ſucceed.

Battles have ever been the laſt reſource of good generals. A ſituation where chance and accident often baffle and overcome the moſt prudential and moſt able arrangements, and where ſuperiority in numbers by no means enſures ſucceſs, is ſuch as is never entered into without a clear neceſſity for ſo doing. The fighting a battle only becauſe the enemy is near, or from having no other formed plan of offence, is a direful way of making war. Darius loſt his crown and life by it: king Harold, of England, did the ſame; and Francis I. at Pavia, loſt the battle and his liberty. King John, of France, fought the battle of Poictiers, though ruin attended his enemy if he had not fought.

The true ſituation for giving battle is when an army's ſituation cannot be worſe, if defeated, than if it does not fight at all; and when the advantage may be great, and the loſs little. Such was the duke of Cumberland's at Haſtenbeck, in 1757, and prince Ferdinand's at Vellinghauſen, in 1761. The reaſons and ſituations for giving battle are ſo numerous, that to treat of them all would fill a large volume: I will therefore content myſelf with the following. There may be exigencies of ſtate that require its army to attack the enemy at all events. Such were the cauſes of the battle of Blenheim, in 1704, of Zorndorff, in 1758, of Cunnerſdorff, in 1759, and of Roſbach, in 1757. To raiſe a ſiege, to defend or cover a country. An army is alſo obliged to engage when ſhut up in a poſt. An army may give battle to effectuate its junction with another army, &c.

The preparations for battle admit of infinite variety. By a knowledge of the detail of battles, the precept will accompany the example. The main general preparations are, to profit by any advantage of ground; that the tactical form of the army be in ſome meaſure adapted to it; and that ſuch form be, if poſſible, a form tactically better than the enemy's; and, in forming the army, to have a moſt careful attention to multiply reſources, ſo that the fate of the army may not hang on one or two efforts; to give any particular part of the army, whoſe quality is ſuperior to ſuch part in the enemy's army, a poſition that enſures action; and, finally, to have a rear by nature, or if poſſible, by art, capable of checking the enemy in caſe of defeat.

The diſpoſitions of battles admit likewiſe of an infinite variety of caſes; for even the difference of ground which happens at almoſt every ſtep, gives occaſion to change the diſpoſition or plan; and a general's experience will teach him to profit by this, and take the advantage the ground offers him. It is an inſtant, a *coup-d'œil*, which decides this: for it is to be feared the enemy may deprive you of thoſe advantages, or turn them to his own profit; and for that reaſon this admits of no preciſe rule, the whole depending on the time and the occaſion.

With regard to battles there are three things to be conſidered; what precedes, what accompanies, and what follows the action. As to what precedes the action, you ſhould unite all your force, examine the advantage of the ground, the wind, and the ſun, (things not to be neglected) and chuſe, if poſſible, a field of battle proportioned to the number of your troops.

You muſt poſt the different kinds of troops advantageouſly for each: they muſt be ſo diſpoſed as to be able to return often to the charge; for he who can charge often with freſh troops, is commonly victorious. Your wings muſt be covered ſo as not to be ſurrounded, and you muſt obſerve, that your troops can aſſiſt each other without any confuſion, the intervals being proportioned to the battalions and ſquadrons.

Great care muſt be taken about the regulation of the artillery, which ſhould be diſpoſed ſo as to be able to act in every place to the greateſt advantage; for nothing is more certain than that, if the artillery be well commanded, properly diſtributed, and manfully ſerved, it will greatly contribute to gaining the battle; being looked upon as the general inſtrument of the army, and the moſt eſſential part of military force. The artillery muſt be well ſupplied with ammunition, and each ſoldier have a ſufficient number of cartridges. The baggage, proviſions, and treaſure of the army, ſhould, on the day of battle, be ſent to a place of ſafety.

In battle, where the attacks are, there is alſo the principal defence. If an army attacks, it forms at pleaſure; it makes its points at will: if it defends, it will be ſometimes difficult to penetrate into the deſigns of the enemy, but when once found, ſuccour ſucceeds to the diſcovery. Ground and numbers muſt ever lead in the arrangement of battles; impreſſion and reſource will ever bid faireſt for winning them.

Battle-*Array*, } *Line of* Battle, } the method and order of arranging the troops in order or line of battle; the form of drawing up the army for an engagement. This method generally conſiſts of three lines, viz. the front line, the rear line, and the reſerve.

The ſecond line ſhould be about 300 paces behind the firſt, and the reſerve at about 5 or 600 paces behind the ſecond. The artillery is likewiſe divided along the front of the firſt line. The front line ſhould be ſtronger than the rear line, that its ſhock may be more violent, and that, by having a greater front, it may more eaſily cloſe on the enemy's flanks. If the firſt line has the advantage, it ſhould continue to act, and attack the enemy's ſecond line, terrified by the defeat of their firſt. The artillery muſt always accompany the line of battle in the order it was at firſt diſtributed, if the ground permit it; and the reſt of the army ſhould follow the motions of the firſt line, when it continues to march on after its firſt ſucceſs.

Battle-*Ax*, an offenſive weapon, formerly much uſed by the Danes, and other northern infantry. It was a kind of halbert, and did great execution when wielded by a ſtrong arm.

Main-Battle. See Battle-*Array*.

BAVINS, in military affairs, implies ſmall faggots, made of bruſh-wood, of a conſiderable length, no part of the bruſh being taken off. See Fascines.

BAYONET, a kind of ſhort hollow dagger, made with a hollow handle, and a ſhoulder, to fix on the muzzle of a firelock or muſket, ſo that neither the charging nor firing is prevented by its being fixed on the piece; and is of infinite ſervice againſt the horſe. At firſt the bayonet was ſcrewed into the muzzle of the barrel, conſequently could not be uſed during the fire. It is ſaid to have been invented by the people of Malacca, and firſt made uſe of on quitting the pikes.

BEAT, in a *military ſenſe*, ſignifies to gain the day, to win the battle, &c.

To Beat *a parley*. See Chamade.

To Beat *a drum*. See Drum.

BEDS, in the military language, are of various ſorts, viz.

Mortar-Beds ſerve for the ſame purpoſe as a carriage does to a cannon: they are made of ſolid timber, conſiſting generally of 2 pieces faſtened together with ſtrong iron bolts and bars. Their ſizes are according to the kind of mortar they carry, and their various dimenſions are ſpecified in the following table. See Plate IV.

Bore		13	10	8	5.8	4.6
Lower bed	length	84.	66.	50.	..	..
	breadth	33.	20.	..	..	..
	height	13.	10.	9.		
Upper bed	length	83.	65.	49.	31.5	28.5
	breadth	32.	25.	19.	16.	14.
	height	13.	12.	11.	10.	9.
Breadth of quarter round		3.	2.5	2.5		
——— of the ogee and fillet		4.	3.5	3.		
Length of the cavity		20.	16.	12.	8.	5.7
Trunnion-hole from fore end		31.	20.	15.5	13.3	11.7
Diameter of trunnion-holes		7.2	6.4	5.4	3.4	2.4
Depth of trunnion-holes		7.	6.	5.	3.2	3.2

N. B. Theſe are the dimenſions of the preſent land mortars. The column at top contains the diameter of each mortar, expreſſed in inches; the other columns are likewiſe inches and decimals. The diſtance of the trunnion-holes is meaſured from the quarter round, and not from the end of the bed. Vid. plate I.

Names and number of iron-work in a 13, 10, *and* 8*-inch mortar-bed.*

Cap-ſquares	2	End riveting-plates	2
Eye-bolts	2	Middle plate	1
Joint-bolts	2	Riveting-bolts	6
Under and upper bed-bolts	9	Square riveting-plates	12
Dowel-bars	4	Traverſing-bolts	6
Rings with bolts	4	Keys, chains and ſtaples	2
Reverſe-bars	2		

Names and number of iron-work in a royal and cochorn mortar-bed. Vid. plate IV. fig. 1 and 2.

Cap-ſquares	2	Handles with ſtarts	2
Eye-bolts	2	Square riveting-plates	5
Joint-bolts	2	Keys, chains and ſtaples	2
Riveting-bolt and ring	1		

Royal-Beds, *Cochorn*-Beds, are carriages for a royal mortar, whoſe diameter is 5.8 inches; and a cochorn mortar, whoſe diameter is 4.6 inches, as mentioned in the preceding table. Thoſe beds are made of one ſolid block only. Plate IV.

Sea-Mortar-Beds, are likewiſe made of ſolid timber, like the former, but differ in their form, having a hole in the centre to receive the pintle or ſtrong iron bolt, about which the bed turns. Sea-mortars are mounted on theſe beds, on board of the bomb-ketches. See Plate V.

Dimenſions of the preſent Sea-Mortar-beds.

Diameter of the bore	13	10
Length of the bed	94.	84.
Breadth of the bed	51.	17.
Height of the bed	27.	23.
Pintle-hole from the fore end	39.	32.
Diameter of the pintle-hole	6. 5	6. 5
Trunnions from the fore end	46.	42. 5
Diameter of the trunnion-holes	10.	8.
Depth of the trunnion-holes	8.	5.
Diameter of the circular bed	59.	59.
Height of the circular bed	8.	6.
Diſtance to the bed-bolſter	15.	10.
Depth of the cavity	15.	12.
Its opening above	30.	21.
Bed bolſter length	53.	14.
Length below	29.	2. 1
Its height	16.	17.
Its breadth	14.	12.

N. B. Theſe beds are placed upon very ſtrong timber frames, fixed into the bomb-ketch, in which the pintle is fixed, ſo as the bed may turn about it, to fire any way. The fore part of theſe beds is an arc of a circle deſcribed from the ſame centre as the pintle-hole. The plans, elevations, and ſections, ſhew in a diſtant manner the ſeveral parts of theſe beds. See Plate V.

Names and quantity of iron-work in ſea-mortar-beds.

Cap-ſquares	2	Croſs bed-bolts	7
Eye-bolts	6	Down bed-bolts	15
Loop-bolts	4	Bed bolſter-plates	2
Traverſing-bolts	4	Keys, chains, and ſtaples	6
Middle-plate	1	Nails to the bed-bolſter bed	4
Riveting-plates	2	Bed-bolſter rings and loops	4
Riveting-bolts	6		
Square riveting-plates for ditto	7		

Stool-Bed, is a piece of wood on which the breech of a gun reſts upon a truck-carriage, with another piece fixed to it at the hind end, that reſts upon the body of the hind axle-tree; and the fore part is ſupported by an iron bolt. See Carriage.

Bed-*Bolts*.
Bed-*Bolſters*. See Carriages and Beds.
Stool Bed-*Bolts*.

BEETLES, in a *military ſenſe*, are large wooden hammers for driving down paliſades, and for other uſes, &c.

BELLS *of Arms*. See Arms.

BELTS, in a *military ſenſe*, are of ſeveral ſorts; as

Sword-Belts, a well-known machine, in which the ſword hangs.

Shoulder-Belts, a broad leather belt, which goes over the ſhoulder, and to which the pouch fixed. They ſhould be made of ſtout ſmooth buff, about 3 inches broad, with two buckles to fix the pouch to the belt. See Pouch.

BERM, in *fortification*, is a little ſpace or path, of about 4, 6, or 8 feet broad, according to the height and breadth of the works, between the ditch and the parapet, when made of turf, to prevent the earth from rolling into the ditch; and ſerves likewiſe to paſs and repaſs.

BESIEGERS, the army that lays ſiege to a fortified place.

BESIEGED, the garriſon that defends the place againſt the army that lays ſiege to it. See Siege.

BILLET, a well-known ticket for quartering ſoldiers.

Billeting, in the *army*, implies the quartering ſoldiers in the houſes of any town or village; which billet intitles each ſoldier, by act of parliament, to candles, vinegar, ſalt, and either ſmall-beer or cyder, not exceeding 5 pints for each man per day, gratis; with the uſe of fire, and the neceſſary utenſils for dreſſing and eating their meat: but, provided the landlord agrees to board them, they are to pay as follows:

Each officer of horſe, under the degree of a captain, per diem, 2s.

Each officer of dragoons, under the degree of a captain, 1s 6d.

Each officer of foot, under the degree of a captain, 1s. and with a horſe, 6d. more.

Each light-horſeman or dragoon, with horſe, 1s.

Each foot ſoldier, 4d.

BIOVAC, in *military affairs*, ſignifies a guard at night, performed by the whole army, which either at a ſiege, or encamped before an enemy, turn out of their tents under arms, and continue ſo all night, to prevent a ſurpriſe. When troops are very much harraſſed, or the dread of the enemy is not great, the two front ranks only remain under arms, whilſt the rear ranks reſt by their arms on the ground; and ſo alternately

BLAST, and BLASTING. See MINES and MINING.

BLINDS, in *military affairs*, are wooden frames, compoſed of 4 pieces, either flat or round, two of which are 6 feet long, and the others 3 or 4 feet, which ſerve as ſpars to faſten the two firſt together: the longeſt are pointed at both ends, and the two others are faſtened towards the extremities of the former, at about 10 or 12 inches from their points, the whole forming a rectangular parallelogram, the long ſides of which project beyond the other about 10 or 12 inches. Their uſe is to fix them either upright, or in a vertical poſition, againſt the ſides of the trenches or ſaps, to ſuſtain the earth. Their points at the bottom ſerve to fix them in the earth, and thoſe at top to hold the faſcines that are placed upon them, ſo that the ſap or trench is formed into a kind of covered gallery, to ſecure the troops from ſtones and grenades.

The term *Blind* is alſo uſed to expreſs a kind of hurdle, made of the branches of trees, behind which the ſoldiers, miners, or labourers, may carry on their work without being ſeen. See HURDLE.

BLINDS, are ſometimes only canvas ſtretched to take away the ſight of the enemy. Sometimes they are planks ſet up, for which ſee MANTLET. Sometimes they are made of a kind of coarſe baſket-work. See GABIONS. Sometimes of barrels, or ſacks filled with earth. In ſhort, they ſignify any thing that covers the labourers from the enemy.

BLIND. See ORILLON and FORTIFICATION.

BLOCKADE, BLOCKADING, in *military affairs*, implies the ſurrounding a place with different bodies of troops, who ſhut up all the avenues on every ſide, and prevent every thing from going in or out of the place. The deſign of the blockade is to oblige thoſe who are ſhut up in the town to conſume all their proviſions, and by that means to compel them to ſurrender for want of ſubſiſtance.

Hence it appears that a blockade muſt laſt a long time, when a place is well provided with neceſſaries; for which reaſon this method of reducing a town is ſeldom taken, but when there is reaſon to believe the magazines are unprovided, or ſometimes when the nature or ſituation of the place permits not the approaches to be made, which are neceſſary to attack it in the uſual way.

Maritime towns, which have a port, are in much the ſame caſe as other towns, when their port can be blocked up, and the beſiegers are maſters of the ſea, and can prevent ſuccours from being conveyed that way into the place.

To BLOCKADE, or to block up a place, is to ſhut up all the avenues, ſo that it can receive no relief either of men or proviſions, &c.

To raiſe a BLOCKADE, is to march from before the place, and leave it free and open as before.

To turn a ſiege into a BLOCKADE, is to deſiſt from a regular method of beſieging, and to ſurround the place with thoſe troops who had formed the ſiege.

To form a BLOCKADE, is to ſurround the place with troops, and hinder any thing from going either in or out.

BLUNDERBUSS, a well-known fire-arm, conſiſting of a wide, ſhort, but very large bore, capable of holding a number of muſket or piſtol balls, very fit for doing great execution in a croud, to make good a narrow paſſage, door of a houſe, ſtair-caſe; or in boarding a ſhip.

BOARD *of Ordnance*. See ORDNANCE.

BOARD, alſo implies an office under the government, where the affairs of ſome department are tranſacted; of which there are ſeveral ſorts in England.

BODY, in *the art of war*, is a number of forces, horſe or foot, united and marching under one commander.

Main BODY *of an army*, ſometimes means the troops encamped in the centre between the two wings, and generally infantry. The main body on a march, ſignifies the whole of the army, excluſive of the van and rear-guard.

BODY *of Reſerve*. See RESERVE.

BODY *of a place*, is, generally ſpeaking, the buildings in a fortified town; yet the incloſure round them is generally underſtood by it.

BOLSTERS. See Waggons.

BOLTS, in *gunnery*, are of ſeveral ſorts: as,

1. *Eye*
2. *Joint*
3. *Tranſom*
4. *Bed*
5. *Breeching*
6. *Bracket*
7. *Stool-bed*
8. *Garniſh*
9. *Axle-tree*
10. *Bolſter*

} Bolts. See Carriage.

BOMB } See Shell.
Cheſt. See Caisson.
Veſſels } ſmall veſſels, made very
Ketches } ſtrong with large beams, particularly calculated for throwing ſhells into a town, caſtle, or fortification, from 13 and 10-inch mortars; two of which are placed on board of each ſhip. They are ſaid to have been invented by one M. Reyneau, a Frenchman, and to have been firſt put in action at the bombardment of Algiers in 1681: 'till then it had been judged impracticable to bombard a place from the ſea.

BOMBARD, an ancient piece of ordnance ſo called, very ſhort, and very thick, with an uncommon large bore. There have been bombards which have thrown a ball or ſhell of 300 weight: they made uſe of cranes to load them. The Turks uſe ſome of them at preſent.

BOMBARDIERS, artillery ſoldiers, ſo called becauſe they are always employed in mortar and howitzer duty. They are to load them on all occaſions; and in moſt ſervices they load the ſhells and grenades, fix the fuzes, prepare the compoſition both for fuzes and tubes, and fire both mortars and howitzers on every occaſion. In the Engliſh ſervice, ſhells and grenades, compoſition for the ſame, fuzes, &c. are prepared in the laboratory by people well ſkilled in that buſineſs.

In moſt foreign ſervices both officers and ſoldiers belonging to the companies of bombardiers have an extrordinary pay, as it requires more mathematical learning to throw ſhells with ſome degree of exactneſs, than is requiſite for the reſt of the artillery. See Artillery Regiment.

To BOMBARD,
BOMBARDING,
BOMBARDMENT, } the act of aſſaulting a city or fortreſs, by throwing ſhells into it, in order to ſet fire to, and ruin the houſes, churches, magazines, &c. and to do other miſchief. As one of the effects of the ſhell reſults from its weight, it is never diſcharged as a ball from a cannon, that is, by pointing it at a certain object: but the mortars in England are fixed at an elevation of 45 degrees; that is, inclined ſo many degrees from the horizon, that the ſhell deſcribes a curve, called the military projectile: hence a mortar, whoſe trunnions are placed at the breech, can have no point-blank range. I am of opinion that mortars ſhould be ſo contrived, that they may be elevated to any degree required, as much preferable to thoſe fixed at an angle of 45°. becauſe ſhells ſhould never be thrown at that angle but in one ſingle caſe only, which ſeldom happens; that is, when the battery is ſo far off, that they cannot otherwiſe reach the works: for when ſhells are thrown from the trenches into the works of a fortification, or from the town into the trenches, they ſhould have as little elevation as poſſible, in order to roll along, and not bury themſelves; whereby the damage they do, and the terror they cauſe to the troops, is much greater than if they ſink into the ground. On the contrary, when ſhells are thrown upon magazines, or any other buildings, with an intention to deſtroy them, the mortar ſhould be elevated as high as poſſible, that the ſhells may acquire a greater force in their fall.

Shells ſhould be loaded with no more powder than is requiſite to burſt them into the greateſt number of pieces, and the length of the fuzes ſhould be exactly calculated according to the required ranges; for, ſhould the fuze ſet fire to the powder in the ſhell before it falls on the place intended, the ſhell will burſt in the air, and probably do more miſchief to thoſe who fired the mortar, than to thoſe againſt whom it was diſcharged. To prevent this, the fuzes are divided into as many ſeconds as the greateſt range requires, conſequently may be cut to any diſtance, at an elevation of 45 degrees.

Mortars are not to be fired with two fires; for when the fuze is properly fixed, and both fuze and ſhell dredged with mealed powder, the blaſt of the powder in the chamber of the mortar, when inflamed by the tube, will likewiſe ſet fire to the fuze in the ſhell.

The following table of loaded-ſhells experiments, was the medium of three different trials, out of the different mortars mentioned, at the Pruſſian camp near Meyſen, in 1761.

TABLE *of* LOADED-SHELLS EXPERIMENTS.

Nature of land-mortars.	Powder in the chamber.		Weight of the mortar.			Strokes to drive the fuze.	Weight of the ſhell fixed.		Weight of powder the ſhell contains.		Quantity of powder uſed.		Time of flight.	Elevation.		Remarks.
Inch.	lb.	oz.	c.	qr.	lb.	N°.	lb.	oz.	lb.	oz.	lb.	oz.	"	°	'	
13	4	8	24	2	1	21	194	,,	9	4½	8	—	16	30	30	broke in 18 pieces
,,	3	,,	,,	,,	,,	,,	192½	,,	,,	,,	7	8	19	45	—	do. 20 do.
10	3	5	10	2	11	18	90	—	4	14⅔	4	6	12	35	15	do. 13 do.
,,	2	,,	,,	,,	,,	,,	89	5	,,	,,	3	12	14	38	30	do. 22 do.
Royal	—	10	—	2	18	12	16	—	1	2	1	—	10	28	25	do. 8 do.
,,	—	12	—	,,	,,	,,	15	12	,,	,,	—	14	13	40	—	do. 19 do.
Coch.	—	5	—	2	28	,,	8	4	—	8	—	7	12	30	—	do. 6 do.
,,	—	6	—	,,	,,	10	8	5	—	,,	—	6	14	38	30	do. 12 do.

BONNETS, in *fortification*, implies a ſmall but uſeful work, that greatly annoys the enemy in their lodgments: is a work conſiſting of 2 faces, which make a ſalient angle in the nature of a ravelin, without any ditch, having only a parapet 3 feet high, and 10 or 12 feet broad. They are made at the ſalient angles of the glacis, outworks, and body of the place, beyond the counterſcarp, and in the fauſſebray. See FORTIFICATION.

BONNETS *à Prêtres*, or *Prieſt's-cap*, in *fortification*, is an outwork, having three ſalient and two inward angles, and differs from the double tenaille only in having its ſides incline inwards towards the gorge, and thoſe of a double tenaille are parallel to each other. See FORTIFICATION.

BORDER, in *military drawings*, implies ſingle or double lines, or any other ornament, round a drawing, &c.

BOOKS, *military*, the compoſition of military gentlemen of experience, genius, and learning, in order to communicate the various branches of the art of war to the public, and to poſterity. It is certain that books are one of the chief inſtruments of acquiring knowledge. They are the repoſitories of the military ſciences, and the vehicles of learning of every kind. As ſuch, I will put down a few of the beſt military books in the Engliſh, German, Dutch, and French languages.

Some of the beſt BOOKS *of artillery and gunnery in Engliſh.*

Robin's Gunnery, &c. 2 vol. 8vo. 1761.

Muller's Treatiſe of Artillery, 8vo. 1768.

Muller's Appendix to the treatiſe of Artillery, 8vo. 1768.

Williams's Theory and Practice of Gunnery, 8vo. 1766.

Simpſon's Theory of Gunnery, 8vo. 1758.

Hollyday's Practical Gunnery, 12mo. 1766.

Gray's Gunnery, 8vo. 1731.

Ardeſoif's Marine Fortification and Gunnery, 8vo. 1772.

Euler's Gunnery, by Mr. Brown, 4to. 1777.

In German.

Struenſee Anfangsgründe der Artillerie, 8vo. 1769.

Eulers erlaüterte Artillerie, 8vo. 1756.

Birnbaums Unterricht für einen Artilleriſten, 4to. 1752.

Buchner's Theoria & Praxis Artilleriæ (in German) 3 vol. folio, printed in 1682, 1683, and 1685 (*).

Dilichius Peribologia (in German) folio, 1640 (†).

In French.

Nouveau Cours de Mathématique, à l'uſage de l'Artillerie, par Belidor, 4to. 1758.

Théorie nouvelle ſur le Méchaniſme de l'Artillerie, par du Lacq, 4to. 1751.

Mémoires de l'Artillerie, par St. Remy, 3 vol. 4to. 1745.

Traité de l'Artillerie, par le Blond, 3 vol. 8vo. 1743.

Obſervations ſur le Canon, 4to. 1772.

Eſſai ſur l'uſage de l'Artillerie, 8vo. 1771.

Examen

(*) This valuable book, on account of its being printed at three different places, and of three different dates, is become exceeding ſcarce even in Germany.

(†) This was probably the firſt printed book of artillery, and is ſeldom met with.

Examen de la Poudre, traduit de l'Italien par Flavigny, 8vo. 1773.

Some of the beſt BOOKS *of fortification in Engliſh.*

Riou's Elements of Fortification, 4to, 1746. vol. 1. *The 2d was never publiſhed.*

Muller's Theory and Practice of Fortification, 2 vol. 8vo. 1764.

Horneck's Remarks on Modern Fortification, 4to. 1758.

Coehorn's Fortification, tranſlated by Saverey, ſolio, 1708.

In German and Dutch.

Speckle, Architectur von Feſtungen, ſolio, 1592. Sec. Edit. 1608 (*).

Dögen's Niederlandiſhe Fortification, folio, 1648.

Celarius vollkommener Feſtungſbau, ſolio, 1656.

Freytag's Fortification, folio, 1665.

Scheiters neuer Feſtungſbau, folio, 1672.

Gründels neu erfundene Fortification, folio, 1673.

Sturms gründliche Anleitung zur Kriegſbaukunſt, 3 vol. 4to. 1755.

Bellerſheim irregulaire Feſtungen, 4to. 1765.

Hahns Kriegs-bau-kunſt, 8vo. 1775.

Humberts Kriegs-kunſt, 8vo. 1756.

Zuckows Kriegs Baukunſt, 4to. Frankf. 1769.

Coehorn's nieuwe Veſting-bouw, folio, 1685.

——— Verſtarkinge des vyf-hooks, folio, 1682.

Coehorn's Wederleginge des Architectura militaris, ſolio, 1683.

In French, Spaniſh, and Italian.

Piedro de Navaro, Fortificatione; *ſuppoſed to be the firſt printed book of fortification*; *without date.*

Franciſco Jeorg Senenſis, Fortificazione; *no date.*

Gerolamo Maggi, del Fortificazione, folio, 1559.

Franciſco de Marchi, Fortificazione, 3 vol. grandos, Roma, 1546 (†).

Pietro Paola Floriani, Fortificazione, folio, 1654.

Pietro Sardi, Corona Imperiale del l'Architecture milit. 1677.

Les Fortifications, par De Ville, 4to. 1666.

Les Fortifications, par M. Pagan, ſolio, 1663.

Architecture militaire, par un Officier de Diſtinction, 2 vol. 4to. 1741.

Vauban véritable Manière de fortifier, par du Fay, 2 vol. 4to. 1757.

Eſſai ſur la Fortification, 8vo. 1755.

Some of the beſt BOOKS *on the art of war, in Engliſh.*

Muller's Attack and Defence of fortified places, 8vo. 1769.

Muller's Field Engineer, from Clairac, 8vo. 1760.

Bell, on Military firſt Principles, 8vo. 1770.

Elementary Principles of Tactics, 8vo. 1771.

Dalrymple's Military Eſſays, 8vo. 1761.

Bigg's Military Hiſtory, from 1739 to 1748, 8vo. 1756.

Pleydel's Eſſay on Field Fortification, 8vo. 1768.

Entick's Hiſtory of the late War, 5 vol. 8vo. 1766.

La Cointe's Science of Military Poſts, 8vo. 1761.

Military Inſtructions for Officers detached in the Field, 1770.

Le Blond's Military Engineer, 2 vol. 8vo. 1759.

Mac Intire's Treatiſe of the Marine Forces, 8vo. 1763.

Jones on Artificial Fireworks, 8vo. 1768.

Treatiſe of the late Wars in the Netherlands, 8vo. 1759.

Simes's Military Works, 3 vol. 8vo. 1772.

Lloyd's Hiſtory of the late Wars, 1 vol. 4to. 1772. *The 2d was never publiſhed.*

Turpin's Art of War, by Otway, 2 vol. 4to. 1761.

In German.

Frederici anleitung zur Kriegs-Wiſſenſchaft, 8vo. 1763.

Genies practiſche Kriegs-kunſt, 8vo. 1760.

Von Lohens Soldat, oder Abhandlung vom Kriegs-ſtande, 8vo. 1752.

Hiſtorie des Kriegs, 6 vol. 8vo. 1758-1762.

Königs von Preuſſen Unterricht von der Kriegs-kunſt an Seine Generals, 8vo. 1761.

Tölner Bildung eines jungen Officiers, 8vo. 1763.

Fäſh groſſe Meiſter in der Kriegs-kunſt, 8vo. 1764.

Jeney der Parteygänger, 8vo. 1766.

Tielke's Feld-Ingenieur, 8vo. Leipz. 1774.

Tielkes

(*) Is very ſcarce, and very valuable, both the editions.

(†) This is the firſt printed book of fortification with a date, and ſuppoſed to be even the very firſt. Hiſtory informs u hat there are only 3 or 4 copies in being; 1 in the king of Pruſſia's library, 1 or 2 in Italy, and 1 in the poſſeſſion olonel Pattiſon, of the royal artillery.

Tielkes Kriegs-kunſt, 4to. Freyb. 1776.

Guiberts Verſuch über die Tactik, 2 vol. 8vo. Dreſd. 1774.

In French.

Art de Guerre, par Principes, & par Règles, par Puiſegur, 2 vol. folio, 1749.

Attaque & la Défenſe des Places, par Vauban, 2 vol. 4to. 1742.

Hiſtoire militaire du Prince Eugene, du Duc de Marlborough, & du Prince d'Orange, par Dumond & Rouſet, 2 vol. folio. 1747.

Petit Guerre, par Grand-Maiſon, 2 vol. 8vo. 1756.

L'Ecole de Mars, par de Guignard, 4to. 1758.

Hiſtoire générale des Guerres, arrivées dans le monde de depuis le Déluge, juſques en 1748, 2 vol. 4to. 1756.

Hiſtoire de Polybe, par M. de Folard, 6 vol. 4to. 1729.

Traité général des Subſiſtances militaires, 2 vol. 4to. 1744.

Traité de la Guerre dernière en Allemagne, 6 vol. 8vo. 1763.

Mémoires de Montecuculi, 2 tom. 8vo. 1758.

Mémoires militaires du Duc de Luxemburg, 6 tom. 4to. 1756.

Guibert, Eſſai général de Tactique, 4to. Lond. 1772.

BOOM, in *marine fortification*, is a long piece of timber, with which rivers or harbours are ſtopped, to prevent the enemy's coming in: it is ſometimes done by a cable or chain, and floated with yards, top-maſts, or ſpars of wood laſhed to it.

BORE, in *gunnery*, implies the cavity of the barrel of a gun, mortar, howitzer, or any other piece of ordnance. &c. Cannon.

BOW, an ancient weapon of offence, made of ſteel, wood, or other elaſtic matter; which, after being bent by means of a ſtring faſtened to its two ends, in returning to its natural ſtate, throws out an arrow with prodigious force.

The uſe of the bow is, without all doubt, of the earlieſt antiquity. It has likewiſe been the moſt univerſal of all weapons, having obtained amongſt the moſt barbarous and remote people, who had the leaſt comminication with the reſt of mankind.

The bow is a weapon of offence amongſt the inhabitants of Aſia, Africa, and America, at this day; and in Europe, before the invention of fire-arms, a part of the infantry was armed with bows. Lewis XII. firſt aboliſhed the uſe of them in France, introducing, in their ſtead, the halbert, pike, and broad ſword. The long-bow was formerly in great uſe in England, and many laws were made to encourage the uſe of it. The parliament under Henry VII. complained of the diſuſe of long-bows, heretofore the ſafeguard and defence of this kingdom, and the dread and terror of its enemies.

Croſs-Bow, is likewiſe an ancient weapon of offence, of the eleventh century. Philip II. ſurnamed the Conqueror, introduced croſs-bows into France. In this reign Richard I. of England, was killed by a croſs-bow at the ſiege of Chalus.

BOXES, in *military affairs*, are of ſeveral ſorts, and for various purpoſes.

Nave-Boxes, are made of iron, and faſtened one at each end of the nave, to prevent the arms of the axle-tree, about which the boxes turn, from cauſing too much friction.

Wood-Boxes, with lids, for holding grape-ſhot, &c. each calibre has its own, diſtinguiſhed by marks of the calibre on the lid.

Tin-Boxes, ſuch as are filled with ſmall ſhot for grape, according to the ſize of the gun they are to be fired out of.

BOYAU, in *fortification*, is a particular trench ſeparated from the others, which, in winding about, incloſes different ſpaces of ground, and runs parallel with the works of the place, that it may be enfiladed. When two attacks are made at once, one near to the other, the boyau makes a communication between the trenches, and ſerves as a line of contravallation, not only to hinder the ſallies of the beſieged, but likewiſe to ſecure the miners.

BRACES, in a *military ſenſe*, ſignifies a kind of armour for the arm; they were formerly a part of a coat-of-mail.

BRACKETS, in *gunnery*, are the checks of the travelling carriage of a mortar; they are made of ſtrong wooden planks. This name is alſo given to that part of a large mortar-bed, where the trunnions are placed, for the elevation of the mortar: they are ſometimes made of wood, and more frequently of iron, of almoſt a ſemicircular figure, well faſtened with nails and ſtrong plates.

BRANCH. See Gallery.

BREACH, in *fortification*, a gap, or opening, in any part of the works of a fortified place, made by the artillery or mines of the beſiegers, preparatory to the making an aſſault.

To repair a Breach, is to ſtop or fill up the gap with gabions, faſcines, &c. and prevent the aſſault.

To fortify a Breach, is to render it inacceſſible with chevaux-de-frize, crow's-feet, &c.

To make a lodgment in the BREACH. After the beſieged are driven away, the beſiegers ſecure themſelves againſt any future attack in the breach.

To clear the BREACH, that is, to remove the ruins, that it may be the better defended.

To BREAK *ground*, to begin to open and work at the trenches in a ſiege, &c.

BREAST-PLATE, in *military antiquity*, a piece of defenſive armour worn on the breaſt of both men and horſes. They are but ſeldom uſed now.

BREAST *work*. See PARAPET.

BREECH *of a gun*, the end near the vent. See CANNON.

BRICKS, in *military architecture*, ſupply the place of ſtone in common buildings, and are compoſed of an earthy matter, hardened by art, to a reſemblance of that kind: they may be very well conſidered as artificial ſtone. Bricks are of very great antiquity, as appears from ſacred hiſtory, the tower of Babel being built with them; and it is ſaid the remains are ſtill viſible. The Greeks and Romans, &c. generally uſed bricks in their buildings, witneſs the Pantheon, &c. In the eaſt they baked their bricks in the ſun. The Romans uſed them unburnt, having firſt left them to dry in the air for 3, 4, or 5 years.

The beſt *bricks* muſt not be made of any earth that is full of ſand or gravel, nor of ſuch as is gritty or ſtony; but of a greyiſh marl, or whitiſh chalky clay, or at leaſt of reddiſh earth. But if there is a neceſſity to uſe that which is ſandy, choice ſhould be made of that which is tough and ſtrong.

The beſt ſeaſon for making *bricks* is the ſpring; becauſe they will be ſubject to crack, and be full of chinks, if made in the ſummer: the loam ſhould be well ſteeped or ſoaked, and wrought with water. They are ſhaped in a mould, and, after ſome drying in the ſun or air, are burnt to a hardneſs. This is our manner of making bricks; but whether they were always made in this manner admits a doubt. We are not clear what was the uſe of ſtraw in the bricks for building in Egypt, or why in ſome part of Germany they mix ſaw-duſt in their clay for bricks.

We are in general tied down by cuſtom to one form, and one ſize; which is truly ridiculous: 8 or 9 inches in length, and 4 in breadth, is our general meaſure: but beyond doubt there might be other forms, and other ſizes, introduced very advantageouſly.

Compaſs BRICKS, are of a circular form; their uſe is for ſteening of walls: we have alſo concave, and ſemi-cylindrical, uſed for different purpoſes.

Grey-Stocks, are make of the pureſt earth, and better wrought: they are uſed in front in building, being the ſtrongeſt and handſomeſt of this kind.

Place-BRICKS, are made of the ſame earth, or worſe, with a mixture of dirt from the ſtreets, and being careleſsly put out of hand, are therefore weaker and more brittle, and are only uſed out of ſight, and where little ſtreſs is laid on them.

Red-Stocks, are made of a particular earth, well wrought, and little injured by mixtures: they are uſed in fine work, and ornaments.

Hedgerly-BRICKS, are made of a yellowiſh coloured loam, very hard to the touch, containing a great quantity of ſand: their particular excellence is, that they will bear the greateſt violence of fire without hurt.

BRIDGES, in *military affairs*, are of ſeveral ſorts and denominations, viz.

Ruſh-BRIDGES, are made of large bundles of ruſhes, bound faſt together, over which planks are laid, and faſtened: theſe are put in marſhy places, for the army to paſs over on any emergency.

Pendant or *hanging* BRIDGES, are thoſe not ſupported by poſts, pillars, or butments, but hung at large in the air, ſuſtained only at the two ends.

Draw-BRIDGE, that which is faſtened with hinges at one end only, ſo that the other may be drawn up; in which caſe the bridge is almoſt perpendicular, to hinder the paſſage of a ditch, &c. There are others made to draw back and hinder the paſſage; and ſome that are open in the middle, one half of which turns away to one ſide, and the other half to the other, and both again joined at pleaſure.

Flying BRIDGE, is generally made of two ſmall bridges, laid one over the other, in ſuch a manner that the uppermoſt ſtretches, and runs out, by the help of certain cords running through pullies placed along the ſides of the upper bridge, which puſh it forwards, 'till the end of it joins the place it is intended to be fixed on. They are frequently uſed to ſurpriſe works, or out-poſts that have but narrow ditches.

BRIDGE *of boats*, is a number of common boats joined parallel to each other, at the diſtance of 6 feet, 'till they reach acroſs the river; which being covered with ſtrong planks, and faſtened with anchors and ropes, the troops march over.

BRIDGE *of communication*, is that made over a river, by which two armies, or forts, which are ſeparated by that river, have a free communication with one another.

Floating-BRIDGE, a bridge made uſe of in form of a work in fortification called a redout; conſiſting of two boats, covered with planks, which are ſolidly framed, ſo as to bear either horſe or artillery. Bridges of this kind are frequently uſed.

Ponton-BRIDGE, a number of tin or copper boats placed at the diſtance of 7 or 8 feet aſunder, each faſtened with an anchor, or a ſtrong rope that goes acroſs the river, running through the rings of the pontons. They are covered with baulks, and then with cheſts or planks, for the army to march over. See PONTON.

Caſk, or *Barrel*-BRIDGE, a number of empty caſks that ſupport baulks and planks, made as above into a bridge, where pontons, &c. are wanting. Experience has taught us that 5 tun of empty caſks will ſupport above water 9000 pounds: hence any calculation may be made.

BRIDGE, in *gunnery*, the two pieces of timber which go between the two tranſums of a gun-carriage, on wich the coins are placed, for elevating the piece. See CARRIAGE.

BRIGADE, in *military affairs*, implies a party, or diviſion of a body of ſoldiers, whether horſe, foot, or artillery, under the command of a brigadier. There are, properly ſpeaking, three ſorts of brigades, viz. the brigade of an army, the brigade of a troop of horſe, and the brigade of artillery. A brigade of the army is either foot or dragoons, whoſe exact number is not fixed, but generally conſiſts of 3 regiments, or 6 battalions: a brigade of horſe may conſiſt of 8, 10, or 12 ſquadrons; and that of artillery, of 8 or 10 pieces of cannon, with all their appurtenances. The eldeſt brigade takes the right of the firſt line, the ſecond of the ſecond line, and the reſt in order, the youngeſt always poſſeſſing the centre. The cavalry and artillery obſerve the ſame order. The troops of horſe-guards in England are divided into ſeveral brigades, according to their ſtrength.

BRIGADE-*Major*, an officer appointed by the brigadier, to aſſiſt him in the management of his brigade. The moſt experienced captains are generally nominated to this poſt; who act in the brigade as major-generals do in the armies, receiving their orders from their commanders.

BRIGADIER, a military officer, whoſe rank is the next above that of a colonel; appointed to command a corps, conſiſting of ſeveral battalions or regiments, called a brigade. This title in England is ſuppreſſed in time of peace, but revived in actual ſervice in the field. Every brigadier marches at the head of his brigade upon duty. The brigadier of foot commands him of horſe in garriſon; and the brigadier of horſe, him of foot in the field. Brigadiers of the horſe-guards command as youngeſt captains of horſe, who have generally ſome higher rank in the army.

BRINGERS *up*, an antiquated military expreſſion, to ſignify the whole rear rank of a battalion drawn up, as being the hindmoſt men of every file.

BRISURE, in *fortification*, is a line of 4 or 5 fathom, which is allowed to the curtain and orillon, to make the hollow tower, or to cover the concealed flank.

BROADSIDE, in *a ſea-fight*, implies the diſcharge of all the artillery on one ſide of a ſhip of war.

BROAD-SWORD. See SWORD.

BUCCANEERS, in *military hiſtory*, a name frequently applied to thoſe famous adventurers, conſiſting of pirates, &c. from all the maritime nations of Europe, who formerly joined together, and made war upon the Spaniards in America.

BUCKLER, a piece of defenſive armour uſed by the ancients, and worn on the left arm.

BUDGE-*Barrels*. See BARREL.

BUFF-*Leather*, in *military accoutrements*, is a ſort of leather prepared from the buffalo, which, dreſſed with oil, after the manner of ſhamoy, makes what is generally called buff-ſkin. Troopers coulets, ſhoulder-belts, and ſword-belts, are made of this leather. The flaps or covers to the grenadiers pouches, and to thoſe of the artillery, are made of this kind of leather.

BULLETS, are leaden balls, wherewith all kinds of ſmall fire-arms are loaded. The diameter of any bullet is found, by dividing 1.6706 by the cube root of the number, which ſhews how many of them make a pound; or it may be done in a ſhorter way. From the logarithm .2228756 of 1.6706 ſubtract continually the third part of the logarithm of the number of bullets in the pound, and the difference will be the logarithm of the diameter required.

Thus the diameter of a bullet, whereof 12 weigh a pound, is found by ſubtracting .3597270, a third part of the logarithm of 12, from the given logarithm .2228756, or, when the logarithm is leſs than the former, an unit muſt be added, ſo as to have 1.2228756, and the difference .8631486 will be the logarithm of the diameter ſought, which is .7297 inches; obſerving that the number found will always be a decimal, when the logarithm, which is to be ſubtracted, is greater than that of one pound; becauſe the diviſor is greater than the dividend in this caſe.

Hence, from the ſpecific gravity of lead, the diameter of any bullet may be found from its given weight: for, ſince a cube foot weighs 11325 ounces, and 678 is to 355 as the cube 1728 of a foot, or 12 inches, is the content of the ſphere, which therefore is 5929.7 ounces; and ſince ſpheres are as the cubes of their diameters; the weight 5929.7 is to 16 ounces, or 1 pound, as the cube 1728 is to the cube of the diameter of a ſphere which weighs a pound; which cube therefore is 4.66263, and its root 1.6706 inches, the diameter ſought.

Hence, the following table of leaden bullets from 1 to 39 in the pound is calculated.

,,	0	1	2	3	4	5	6	7	8	6
0	0	1.671	1.326	1.158	1.05	.977	.919	.873	.835	.803
1	.715	.751	.730	.711	.693	.677	.663	.650	.637	.626
2	.615	.605	.596	.587	.579	.571	.564	.557	.550	.544
3	.538	.532	.526	.521	.517	.511	.506	.501	.497	.493

The diameter of muſket bullets differs but 1-50th part from that of the muſket bore; for if the ſhot but juſt rolls into the barrel, it is ſufficient. Government allows 11 bullets in the pound for the proof of muſkets, and 14 in the pound, or 29 in two pounds, for ſervice; 17 for the proof of carbines, and 20 for ſervice; and 28 in the pound for the proof of piſtols, and 34 for ſervice.

BULWARK, the ancient name for baſtion or rampart, which words ſee.

BURDEN, } BURTHEN, } in a *general ſenſe*, implies a load or weight, ſuppoſed to be as much as a man, horſe, &c. can well carry. A ſound healthful man can raiſe a weight equal to his own, can alſo draw and carry 50lb. a moderate diſtance. An able horſe can draw 350lb. though in length of time 300 is ſufficient. Hence all artillery calculations are made. One horſe will draw as much as 7 men, and 7 oxen will draw as much as 11 or 12 horſes.

BURIALS, as practiſed by the military, are as follow, viz. The funeral of a field-marſhal ſhall be ſaluted with 3 rounds of 15 pieces of cannon, attended by 6 battalions, and 8 ſquadrons.

That of a general, with 3 rounds of 11 pieces of cannon, 4 battalions, and 6 ſquadrons.

That of a lieutenant-general, with 3 rounds of 9 pieces of cannon, 3 battalions, and 4 ſquadrons.

That of a major-general, with 3 rounds of 7 pieces of cannon, 2 battalions, and 3 ſquadrons.

That of a colonel, by his own battalion, or an equal number by detachment, with 3 rounds of ſmall arms.

That of a lieutenant-colonel, by 300 men and officers, with 3 rounds of ſmall arms.

That of a major, by 200 men and officers, with 3 rounds of ſmall arms.

That of a captain, by his own company, or 70 rank and file, with 3 rounds of ſmall arms.

That of a lieutenant, by 1 lieutenant, 1 ſerjeant, 1 drummer, 1 fifer, and 36 rank and file, with 3 rounds.

That of an enſign, by an enſign, a ſerjeant, and drummer, and 27 rank and file, with 3 rounds.

That of a ſerjeant, by a ſerjeant, and 19 rank and file, with 3 rounds of ſmall arms.

That of a corporal, muſician, private man, drummer, and fife, by one ſerjeant and 13 rank and file, with three rounds of ſmall arms.

All officers, attending the funerals of even their neareſt relations, ſhall notwithſtanding wear their regimentals, and only have a black crape round their left arm.

The pall to be ſupported by officers of the ſame rank with that of the deceaſed: if the number cannot be had, officers next in ſeniority are to ſupply their place.

BURR, in *gunnery*, a round iron ring which ſerves to rivet the end of the bolt, ſo as to form a round head like that of a bolt. See CARRIAGE.

BUSKINS, a kind of ſhoe, or half boot, adapted to either foot; formerly a part of the Roman dreſs, particularly for tragic actors on the ſtage. They are now much worn by the army.

BUTTON, in *gunnery*, a part of the caſcable, in either a gun or howitzer, and is the hind part of the piece, made round in the form of a ball. See CANNON.

BUTT, in *gunnery*, is a ſolid earthen parapet to fire againſt in the proving of guns, or in practice.

BUTTRESS. See COUNTERFORT.

C

CADENCE, in *tactics*, implies a very regular and uniform method of marching, by the drum and muſic, beating time: it may not be improperly called mathematical marching; for after the length of the ſtep is determined, the time and diſtance may be found. It is by a continual practice and attention to this, that the Pruſſians have arrived at that point of perfection, ſo much admired in their evolutions.

CADET, among the military, implies a young gentleman who applies himſelf to the ſtudy of fortification and gunnery, &c. and who ſometimes ſerves in the army, with or without pay, 'till a vacancy happens for his promotion. There is a company of gentlemen cadets maintained at Woolwich, at the king's expence, where they are taught all the ſciences neceſſary to form a complete officer. Their number is 48, and commiſſions are given to them when qualified. The proper ſignification of the word is, younger brother. See ACADEMY.

CÆSTUS, in *military antiquity*, was a large gauntlet, compoſed of raw hides, uſed by wreſtlers at the public games.

CAISSON, in *military affairs*, is a wooden frame or cheſt, made ſquare, the ſide planks about 2 inches thick: it may be made to contain from 4 to 20 loaded ſhells, according to the execution they are to do, or as the ground is firmer or looſer. The ſides muſt be high enough, that when the cover is nailed on, the fuzes may not be damaged. *Caiſſons* are buried under ground at the depth of 5 or 6 feet, under ſome work the enemy intends to poſſeſs himſelf of; and when maſter of it, fire is put to the train conveyed through a pipe, which inflames the ſhells, and blows up the aſſailants. Sometimes a quantity of looſe powder is put into the cheſt, on which the ſhells are placed, ſufficient to put them in motion, and raiſe them above ground: at the ſame time that blaſt of powder ſets fire to the fuze in the ſhells, which muſt be calculated to burn from 1 to 2½ ſeconds. When no powder is put under the ſhells, a ſmall quantity of mealed powder muſt be ſtrewed over them, having a communication with the ſauciſſon, in order to convey the fire to the fuzes.

CAISSON, as in ſome old *military books*, is a covered waggon, to carry bread or ammunition.

CALCULATION, in *military affairs*, is the art of computing the amplitudes of ſhells, time of flight, projectile curve, velocity of ſhots, charges of mines, &c. together with the neceſſary tables for practice.

CALIBER, in *gunnery*, ſignifies the ſame as their bore or opening; and the diameter of the bore is called the diameter of its caliber. This expreſſion regards all pieces of artillery.

CALIBER-*Compaſſes*, }
CALLIPER-*Compaſſes*, } the name of a particular inſtrument uſed by gunners, for meaſuring the diameters of ſhot, ſhells, &c. as alſo the cylinder of cannon, mortars, and howitzers. They reſemble other compaſſes, except in their legs, which are arched, in order that the points may touch the extremities of the arch. To find the true diameter of a circle, they have a quadrant faſtened to one leg, and paſſing through the other, marked with inches and parts, to expreſs the diameter required: the length of each ruler or plate is uſually between the limits of 6 inches and a foot. On theſe rulers are a variety of ſcales, tables, proportions, &c. ſuch as are eſteemed uſeful to be known by gunners. The following articles are on the completeſt gunners-callipers, viz. 1. The meaſure of convex diameters in inches. 2. Of concave ditto. 3. The weight of iron ſhot from given diameters. 4. The weight of iron ſhot for given gun bores. 5. The degrees of a ſemicircle. 6. The proportion of troy and averdupoiſe weight. 7. The proportion of Engliſh and French feet and pounds. 8. Factors uſed in circular and ſpherical figures. 9. Tables of the ſpecific gravity and weights of bodies. 10. Tables of the quantity of powder neceſſary for proof and ſervice of braſs and iron guns. 11. Rules for computing the number of ſhot or ſhells in a finiſhed pile. 12. Rule concerning the fall of heavy bodies. 13. Rules for raiſing of water. 14. Rules for firing artillery and mortars. 15. A line of inches. 16. Logarithmetic ſcales of numbers, ſines, verſed ſines and tangents. 17. A ſectoral line of equal parts, or the line of lines. 18. A ſectoral line of plans and ſuperficies. 19. A ſectoral line of ſolids.

CALQUING, }
CALKING, } the art of tracing any kind of a military drawing, &c. upon ſome plate, paper, &c. It is performed by covering the backſide of the drawing with a black or red colour, and fixing the ſide ſo covered upon a piece of paper, waxed plate, &c. This done, every line in the drawing is to be

traced over with a point, by which means all the outlines of the drawing will be transferred to the paper or plate, &c.

CALTROPS, in *military affairs*, is a piece of iron having 4 points, all diſpoſed in a triangular form; ſo that 3 of them always reſt upon the ground, and the 4th ſtands upwards in a perpendicular direction. Each point is 3 or 4 inches long. They are ſcattered over the ground and paſſages where the enemy is expected to march, eſpecially the cavalry, in order to embarraſs their progreſs.

CAMISADE, in *military tranſactions*, implies an attack by ſurpriſe, either during the night, or at break of day, when the enemy is ſuppoſed to be aſleep.

CAMOUFLET, in *war*, a kind of ſtinking combuſtibles blown out of paper caſes, into the miners faces, when they are at work in the galleries of the countermines.

CAMP, in *military affairs*, is the whole extent of ground, in general, occupied by an army pitching its tents when in the field, and upon which all its baggage and apparatus are lodged. It is marked out by the quarter-maſter-general, who allots every regiment its ground. The extent of the front of a regiment of infantry is 200 yards, including the two battalion guns, and depth 320, when the regiment contains 9 companies, each of 100 private men, and the companies tents in two rows; but when the companies tents ſtand in one row, and but 70 private men to each row, the front is then but 155 yards. A ſquadron of horſe has 120 yards in front, and 100 for an interval between each regiment.

The nature of the ground muſt alſo be conſulted, both for defence againſt the enemy, and ſupplies for the army. It ſhould have a communication with their own garriſons, and have plenty of water, forage, and fuel, and either rivers, marſhes, hills, or woods to cover it. An army always encamps fronting the enemy, and generally in two parallel lines, beſides a corps de reſerve, about 500 yards diſtant from each other: the horſe and dragoons on the wings, and the foot in the centre. Where, and how the train of artillery is encamped, ſee *Park of artillery*, and *Encampment of a regiment of artillery*, under the word *Artillery*. Each regiment poſts a ſubaltern's guard at 80 yards from the colours to the officers tent, called the *quarter-guard*, beſides a corporal's guard in the rear: and each regiment of horſe or dragoons, a ſmall guard on foot, called the *ſtandard-guard*, at the ſame diſtance. The grand guard of the army conſiſts of horſe, and is poſted about a mile diſtant towards the enemy.

In a ſiege, the *camp* is placed all along the line of circumvallation, or rather in the rear of the approaches, out of cannon-ſhot: the army faces the circumvallation, if any; that is, the ſoldiers have the town in their rear.

One thing very eſſential in the eſtabliſhing a *camp*, and which ſhould be particularly attended to, if the enemy is near; is, that there ſhould not only be a commodious ſpot of ground at the head of the camp, where the army, in caſe of ſurpriſe, may in a moment be under arms, and in a condition to repulſe the enemy; but alſo a convenient field of battle at a ſmall diſtance, and of a ſufficient extent for them to form in advantageouſly, and move with facility. See Pl. VIII. and IX.

CAMP-*Utenſils*, in war time, are hatchets, ſhovels, mattocks, blankets, camp-kettles, canteens, tents, poles and pins: that is, each company has 10 ſhovels, and 5 mattocks; each tent 1 hatchet, 2 blankets, 1 camp-kettle, with its linen bag; and each ſoldier 1 canteen and a knapſack.

CAMP-*Colour-men*. Each regiment has generally 6, and ſometimes 1 per company: they always march with the quarter-maſter, to aſſiſt in making the neceſſary preparations againſt the arrival of the regiment in a new encampment. They likewiſe carry the camp-colours.

Flying-CAMP, or army, is generally meant a ſtrong body of horſe and foot, commanded for the moſt part by a lieutenant-general, which is always in motion, both to cover its own garriſons, and to keep the enemy's army in a continual alarm. It alſo ſignifies the ground on which ſuch a body of men encamps.

CAMPAIGN, in *military affairs*, the time every year that an army continues in the field, in war time. We alſo ſay, a man as ſerved ſo many campaigns, i. e. years; the campaign will begin at ſuch a time, this will be a long campaign, &c. The word is alſo uſed for an open country before any towns, &c.

CANNON, in the *military art*, implies a tube of braſs or iron; they are charged with powder and ball, or ſometimes cartridges, grape, and tin-ſhot, &c. The length is diſtinguiſhed by three parts; the firſt re-inforce, the ſecond re-inforce, and the chace: the firſt re-inforce is 2-7ths, and the ſecond 1-7th and a half of the diameter of the ſhot. The inſide hollow, wherein the powder and ſhot are lodged, is called the bore, &c. See Plate VI. where every part is mentioned.

Hiſtory of CANNON. They were originally made of iron bars ſoldered together, and fortified with ſtrong iron hoops; ſome of which are ſtill to be ſeen, viz. one in the tower of London, two at Woolwich, and one in the royal arſenal at Liſbon. Others were made of thin ſheets of iron rolled up together, and hooped; and on emergencies they were made of leather, with plates of iron or copper. Theſe pieces were made in a rude and imperfect manner, like the firſt eſſays of many new inventions. Stone balls were thrown out of theſe cannon, and a ſmall quantity of powder uſed on account of their weakneſs. Theſe pieces have no ornaments, were placed on their carriages by rings, and are of cylindrical form. When or by whom they were made, is uncertain; however, we read of *cannon* being uſed as early as the 13th century, in a ſea engagement between the king of Tunis and the Mooriſh king of Seville. The Venetians uſed *cannon* at the ſiege of Claudia Jeſſa, now called Chioggia, in 1366, which were brought thither by two Germans, with ſome powder and leaden balls; as likewiſe in their wars with the Genoeſe in 1379. Our glorious king Edward III. made uſe of *cannon* at the battle of Creſſy in 1346, and at the ſiege of Calais in 1347. *Cannon* were made uſe of by the Turks at the ſiege of Conſtantinople, then in poſſeſſion of the Chriſtians, in 1394, or in that of 1452, that threw a weight of 500lb. but they generally burſt, either the firſt, ſecond, or third ſhot. Louis XII. had one caſt at Tours, of the ſame ſize, which threw a ball from the Baſtille to Charenton. One of thoſe famous *cannon* was taken at the ſiege of Dieu in 1546, by Don John de Caſtro, and is in the caſtle of St. Juilião da Barra, 10 miles from Liſbon; its length is 20 feet 7 inches, diameter at the centre 6 feet 3 inches, and diſcharges a ball of 100lb. It has neither dolphins, rings, nor button, is of a curious kind of metal, and has a large Indoſtan inſcription upon it, which ſays it was caſt in 1400.

CANNON { *Ball.* See BALLS.
{ *Shot.* See SHOT.

To CANNONADE, in *war*, is to make a very reſpectable fire out of the great guns.

CANNONIER, the perſon who manages the guns. See GUNNER.

Ancient and preſent names of CANNON. Formerly they were dignified with uncommon names; for in 1503 Louis XII. had 12 braſs cannon caſt, of an uncommon ſize, called after the names of the 12 peers of France. The Spaniſh and Portugueſe called them after their ſaints. The emperor, Charles V. when he marched before Tunis, founded the 12 Apoſtles. At Milan there is a 70-pounder, called the Pimontelle; and one at Bois-le-duc, called the Devil. A 60-pounder at Dover caſtle, called Queen Elizabeth's Pocket-piſtol. An 80-pounder in the tower of London (formerly in Sterling caſtle) called Mounts-meg. An 80-pounder in the royal arſenal at Berlin, called the Thunderer. An 80-pounder at Malaga, called the Terrible. Two curious 60-pounders in the arſenal at Bremen, called the Meſſengers of bad news. And laſtly, an uncommon 70-pounder in the caſtle of St. Angelo at Rome, made of the nails that faſtened the copper plates which covered the ancient Pantheon, with this inſcription upon it: *Ex clavis trabalibus porticus Agrippæ.*

In the beginning of the 15th century theſe uncommon names were generally aboliſhed, and the following more univerſal ones took place, viz.

	Pounders.	Cwt.
Cannon royal, or carthoun	= 48	about 90
Baſtard cannon, or ¾ carthoun	= 36	79
½ carthoun	= 24	60
Whole culverins	= 18	50
Demy culverins	= 9	30
Falcon	= 6	25
Saker loweſt ſort	= 6	13
ordinary	= 5	15
largeſt ſize	= 8	18
Baſiliſk	= 48	85.
Serpentine	= 4	8
Aſpik	= 2	7
Dragon	= 6	12
Syren	= 60	81
Falconet	= 3, 2, & 1	15, 10, 5.

Moyens, which carried a ball of 10 or 12 ounces, &c.

Rabinet, which carried a ball of 16 ounces.

Theſe curious names of beaſts and birds of prey were adopted, on account of their ſwiftneſs in motion, or of their cruelty; as the *falconet, falcon, ſacker, and culvering*, &c. for their ſwiftneſs in flying; the *baſiliſk, ſerpentine, aſpike, dragon, ſyren*, &c. for their cruelty. See the Latin poet Forcaſtarius.

At preſent *cannon* take their names from the weight of the ball they diſcharge: thus a piece that diſcharges a ball of 24 pounds, is called a 24-pounder; one that carries a ball of 12 pounds, is called a 12-pounder; and ſo of the reſt, divided into the following ſorts, viz.

Ship-guns, conſiſting in 42, 36, 32, 24, 18, 12, 9, 6, and 3 pounders.

Garriſon-guns, in 42, 32, 24, 18, 12, 9 and 6 pounders.

Battering-guns, in 24, 18, and 12 pounders.

Field-pieces, in 12, 9, 6, 3, 2, 1½, 1, and ½ pounders, whoſe dimenſions are explained in the following tables, except the ſmall pieces, which differ in length and weight, viz.

TABLE *of Ship-guns, ſettled in* 1753.

Braſs Ship-guns.						Iron Ship-guns.					
Caliber.	Length.		Weight.			Caliber.	Length.		Weight.		
42	9	6	61	2	10	42	10	0	55	1	12
32	9	5	55	2	7	32	9	6	53	3	23
24	9	5	51	1	12	24	9	5	48	0	0
18	9	0	48	1	0	18	9	0	41	1	8
12	9	0	29	0	0	12	9	0	32	3	3
9	8	5	26	0	0	9	8	5	23	2	2
6	8	0	19	0	0	6	7	0	17	1	14
3	6	5	11	0	0	4	6	0	12	2	13
						3	4	6	7	1	7

N. B. The length is expreſſed in feet and inches, and the weight in centres, quarters, and pounds.

TABLE *of Garriſon-pieces.*

Braſs Garriſon-pieces						Iron Garriſon-pieces					
Caliber.	Length.		Weight.			Caliber.	Length.		Weight.		
42	10	0	64	0	0	32	9	8	56	0	0
32	9	2	49	2	18	24	9	8	48	0	0
24	8	4	37	0	0	18	9	0	36	0	0
18	7	6	27	3	0	12	7	8	24	0	0
12	6	7	18	2	0	9	7	0	18	0	0
9	6	0	13	3	0	6	6	1	12	0	0
6	5	3	9	1	0	4	5	4	8	0	0

Braſs Battering-pieces.

New pieces.					
Caliber.	Length.		Weight.		
24	9	8	27	0	0
18	9	0	20	1	0
12	7	8	13	2	0

Braſs Field-pieces.

New pieces.					
Caliber.	Length.		Weight.		
12	5	0	8	3	8
6	4	6	4	3	10
3	3	6	2	3	10

The metal of which braſs cannon are made, is in a manner kept a ſecret by the founders; yet, with all their art and ſecreſy, they have not hitherto found out a compoſition that will ſtand a hot engagement without melting, or at leaſt being rendered uſeleſs. Thoſe caſt at Woolwich bid faireſt towards this amendment. The reſpective quantities which ſhould enter into this compoſition, is a point not decided; every founder has his own proportions, which are peculiar to himſelf. The moſt common proportions of the ingredients are the following, viz. To 240 lb. of metal fit for caſting, they put 68 lb. of copper, 52 lb. of braſs, and 12 lb. of tin. To 4200 lb. of metal fit for caſting, the Germans put $3687\frac{34}{41}$ lb. of copper, $204\frac{12}{41}$ lb. of braſs, and $307\frac{36}{41}$ lb. of tin. Others again uſe 100 lb. of copper, 6 lb. of braſs, and 9 lb. of tin; and laſtly, others 100 lb. of copper, 10 lb. of braſs, and 15 lb. of tin. With reſpect to iron guns, their ſtructure is the ſame as that of the others, and they generally ſtand the moſt ſevere engagements, being frequently uſed on ſhip-board. Several experiments have taught us that the Swediſh iron guns are preferable to all others.

CANNON is now generally caſt ſolid, and the cavity bored afterwards by a very curious machine for that purpoſe, where the gun is placed in a perpendicular poſition; but of late theſe machines have been made to bore horizontally, and much truer than thoſe that bore in a vertical form. This new machine was firſt invented at Straſburg, and greatly improved by Mr. Verbruggen, a Dutchman, at preſent head founder at the royal foundery at Woolwich, where probably the beſt horizontal-boring machine in Europe has been lately fixed; it both bores the inſide, and turns and poliſhes the outſide at once.

Names of the ſeveral parts of a CANNON. See Plate VI.

The grand diviſions exterior, are as follow, viz. *Firſt re-inforce,* is that part of a gun next the breech, which is made ſtronger, to reſiſt the force of powder.

Second re-inforce. This begins where the firſt ends, and is made ſomething ſmaller than the firſt.

The chace, is all that part from the trunnions to the muzzle.

The muzzle, properly ſo called, is the part from the muzzle aſtragal to the end of the piece.

Small diviſions exterior.

The caſcable, the hindermoſt part of the breech, from the baſe-ring to the end of the button.

The caſcable-aſtragal, is that diminiſhing part between the two breech-mouldings.

The neck of the caſcable, is that narrow ſpace between the breech-moulding and the button.

The breech, is that ſolid piece of metal behind, between the vent and the extremity of the baſe-ring, and which terminates the hind part of the gun, excluſive of the caſcable.

The breech-mouldings, are thoſe eminent parts, as ſquares or rounds, which ſerve only for ornaments to the piece, &c.

The baſe-ring and ogee, are ornamental mouldings: the latter is always in the ſhape of an S, taken from civil architecture, and uſed in guns, mortars, and howitzers.

The vent-field, is the part from the vent to the firſt re-inforce aſtragal.

The vent aſtragal and fillets, are the mouldings and fillets at or near the vent.

The charging cylinder, is all the ſpace from the chace-aſtragal to the muzzle-aſtragal.

The firſt re-inforce ring and ogee, is the ornament on the ſecond re-inforce.

The firſt re-inforce aſtragal, is the ornament between the firſt and ſecond re-inforce.

The chaſe-girdle, is the ornament cloſe to the trunnions.

The trunnions, are two ſolid cylindrical pieces of metal in every gun, which project the piece, and by which it is ſupported upon its carriage.

The dolphins, are the two handles placed on the ſecond re-inforce ring of braſs guns, reſembling the fiſh of that name: they ſerve for mounting and diſmounting the guns.

The ſecond re-inforce ring and ogee, are the two ornaments joining the trunnions.

The ſecond reinforce-aſtragal, is the moulding neareſt the trunnions.

The chaſe-aſtragal and fillets, the two laſt-mentioned ornaments jointly.

The muzzle-aſtragal and fillets, the joint ornaments neareſt the muzzle.

The muzzle-mouldings, the ornaments at the very muzzle of the piece.

The ſwelling of the muzzle, the projected part behind the muzzle-mouldings.

Interior parts.

The mouth, or entrance of the bore, is that part where both powder and ball are put in, or the hollow part which receives the charge.

The vent, in all kinds of fire-arms, is vulgarly called the touch-hole: it is a ſmall hole pierced at the end, or near it, of the bore or chamber, to prime the piece with powder, or to introduce the tube, in order, when lighted, to ſet fire to the charge.

The chamber, which is only in large calibres, is the place where the powder is lodged, which forms the charge.

Tools for loading and firing CANNON, are rammers, ſponges, ladles, worms, hand-ſpikes, wedges, and ſcrews.

Coins, or *wedges,* to lay under the breech of the gun, in order to elevate or depreſs it.

Hand-ſpikes, ſerve to move and to lay the gun.

Ladles, ſerve to load the gun with looſe powder.

Rammers, are cylinders of wood, whoſe diameters and *axes* are equal to thoſe of the ſhot: they ſerve to ram home the wads put upon the powder and ſhot.

Sponge, is fixed at the oppoſite end of the rammer, covered with lamb-ſkin, and ſerves to clean the gun when fired.

Screws, are uſed to field-pieces, inſtead of coins, by which the gun is kept to the ſame elevation.

Tools neceſſary for proving CANNON, are, a ſearcher with a reliever, and a ſearcher with one point.

Searcher, is an iron, hollow at one end to receive a wooden handle, and on the other end has from 4 to 8 flat ſprings of about 8 or 10 inches long, pointed and turned outwards at the ends.

The Reliever, is an iron flat ring, with a wooden handle, at right angles to it. When a gun is to be ſearched after it has been fired, this ſearcher is introduced and turned every way, from end to end; and if there is any hole, the point of one or other of the ſprings gets into it, and remains 'till the reliever, paſſing round the handle of the ſearcher, preſſing the ſprings together, relieves it.

When there is any hole or roughneſs in the gun, the diſtance from the mouth is marked on the outſide with chalk.

The other ſearcher has alſo a wooden handle, and a point at the fore end, of about an inch long, at right angles to the length: about this point is put ſome wax, mixed with tallow, which, when introduced into the hole or cavity, is preſſed in, when the impreſſion upon the wax gives the depth, and the length is known by the motion of the ſearcher backwards and forwards: if a hole is $\frac{1}{9}$ of an inch deep, the gun is rejected. See INSTRUMENTS.

Charges for all the different pieces, and on all occaſions, in garriſon and the field.

In order to render this difficult article viſible on ſpeculation, I have formed the following table. See PROOF.

Nat.	Proof				Service.				Saluting.		Ricochet.		Diameter of				Length of cart.			
	Braſs.		Iron.		Braſs.		Iron.						Guns.		Shot.		Proof.		Service	
pds.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	In.	pts.	In.	pts.	In.	pts.	In.	pts.
42	31	8	25		14		12		10	4	4	7	7	018	6	684	26	94	17	79
32	26	12	21	8	10	10	9	4	8		2	12	6	410	6	105	26	3	16	25
24	21		18		8		8		6		2		5	824	5	547	25	58	14	78
18	18		15		6		8		4	8	1	12	5	292	5	040	24	92	13	46
12	12		12		4		4		3		1	6	4	623	4	403	23	24	11	72
9	9		9		3		3		2	8	1	4	4	200	4		21	26	10	63
6	6		6		2	8	2	8	2		1		3	668	3	498	18	7	9	35
4	4		4		1	6	1	8	1	4		12	3	204	3	003	16	43	8	12
3	3		3		1		1			12		8	2	913	2	775	14	84	7	42
1½	1	8	1	8		8		8		6		4	2	031	2	020	11	76	5	88
1	1		1			5		5		4		2¼	2	019	1	923	8	35	3	18

The price of artillery.

The government pays 130l. per ton for braſs cannon, 12l. for each horſe; and a fixed price is allowed for carriages, wheels, iron-work, tumbrels, ammunition, and ball. For cannon ball the government allows 16l. per ton, and 8l. 8s. per quintal for gunpowder. Hence a 24-pounder, with all its appurtenances, ready to act againſt an enemy, ſtands the government in 324l. 19s. 5½d. a 12-pounder, in 208l. 10s. 6d. and a 6-pounder, in 119l. 14s. 6½d.

CANNON-*Baſkets.* See GABIONS.

To nail CANNON. See NAIL.

CANTEENS, in *military articles*, implies a tin veſſel uſed by the ſoldiers on a march, &c. to carry water or other drinkables in, and holds about 2 quarts.

CANTONMENTS, in *military affairs*, is the quartering the army as near to each other as poſſible, and in the ſame manner they incamped in the field. The chief reaſons for cantoning an army are, firſt, when the campaign begins early; on which occaſion, in cantoning your troops, two objects demand attention, viz. the military object, and that of ſubſiſtance: the 2d is, when an army has finiſhed a ſiege early, the troops are allowed to repoſe 'till the fields produce forage for their ſubſiſtance: the 3d reaſon is, when the autumn proves rainy, and forage ſcarce, the troops are cantoned to protect them from the bad weather.

CANVAS-*Bags.* See BAGS, *Sand*-BAGS, &c.

CAPS, in *gunnery*, are pieces of leather, or more commonly ſheep-ſkins, to cover the mouth of mortars when loaded, 'till they are fired, to prevent damps, or rain getting in.

CAP-*Squares.* See CARRIAGES.

CAPITAL, in *fortification*, is an imaginary line which divides any work into two equal and ſimilar parts. It ſignifies alſo, a line drawn from the angle of a polygon to the point of the baſtion, or from the point of the baſtion to the middle of the gorge.

CAPITULATION, in *military affairs*, implies the conditions on which the garriſon of a place beſieged agree to deliver it up, &c. This is likewiſe the laſt action, both in the attack and defence of a fortification, the conditions of which may be of various kinds, according to the different circumſtances or ſituations in which they are.

As ſoon as the capitulation is agreed on, and ſigned, hoſtages are generally delivered on both ſides, for the exact performance of the articles; part of the place is delivered to the beſiegers, and a day appointed for the garriſon to evacuate the place. The uſual and moſt honourable conditions are, with arms and baggage, drums beating, and colours flying, matches lighted, and ſome pieces of artillery; waggons, and convoys for the baggage, ſick and wounded, &c.

CAPONIER, in *fortification*, is a paſſage made from one work to another, of 10 or 12 feet wide, and about 5 feet deep, covered on each ſide by a parapet, terminating in a glacis. Sometimes they are covered with planks and earth. See FORTIFICATION.

CAPSTERN, CAPSTAN, } in *military mechanics*, ſignifies a ſtrong maſſy piece of timber in the form of a truncated cone, and having its upper part, called the drum-head, pierced with a number of ſquare holes, for receiving the levers; and by turning it round, ſeveral actions may be performed that require an extraordinary power.

CAPTAIN, in *military affairs*, is a military officer, who is the commander in chief of a company of foot, artillery, horſe, or dragoons. The name of captain was the firſt term made uſe of to expreſs the chief or head of a company, troop, or body of men. He is both to march and fight at the head of his company. A captain of artillery and engineers ought to be more a maſter of the attack and defence of fortified places than either a captain of infantry or cavalry; becauſe they muſt be good mathematicians, and underſtand the raiſing of all kinds of batteries, to open the trenches, to conduct the ſap, to make mines and fougaſſes, and to calculate their charges. They ought further to be well acquainted with the power of artillery, the doctrine of the military projectile, and the laws of motion, together with the ſyſtem of mechanics; and ſhould be good draughtſmen. A captain has in moſt ſervices the power of appointing his own ſerjeants and corporals, but cannot by his own authority break them; neither can he puniſh a ſoldier with death, unleſs he revolts againſt him on duty. Among the horſe, when captains of ſeveral regiments meet, he that has the eldeſt commiſſion takes place and commands; but among the foot, the captain of the eldeſt regiment commands all that are of younger regiments, though they have elder commiſſions. The ſame denomination is given to him that commands a ſhip of war, or the like. Captains of the guards in the Engliſh ſervice rank as colonels in marching regiments; the captains of artillery in the Pruſſian ſervice rank as majors in the army, and have an extraordinary pay, on account of the great qualifications that monarch demands of them; and the captains of bombardiers, miners, and artificers, in the Portugueſe ſervice, have 3l. 7s. 6d. a month more than the captains of artillery in the ſame regiment.

CAPTAIN-*Lieutenant*, the commanding officer of the colonel's company or troop in every regiment. He commands as youngeſt captain, though in reality he is only the firſt lieutenant, the colonel being himſelf captain. This denomination was aboliſhed in the Engliſh army in 1772, when it was ordered that for the future all captain-lieutenants ſhould have the rank and title of captains in the army. This title is ſtill uſed in all foreign ſervices.

CAPITAINE *en pied*, or captain in pay, one who is not reformed, but keeps in full pay, and exempt from duty. This expreſſion occurs ſometimes in hiſtory.

CAPTAIN *reformed*, one who, upon reducing the forces on the termination of war, loſes his company, yet keeps his rank and pay, whether on duty or not.

CAPTAIN *on half pay*, is one who loſes his company on the reduction of an army, and retires on half-pay, until ſeniority puts him into duty and full pay again.

CAPTAIN *en ſecond*, or ſecond captain, is one whoſe company has been broke, and who is joined to another, to ſerve under the captain of it. This is cuſtomary in France, but not in England.

CAPITAINE *des gardes*, or captain of the guards, is the captain of a company in any of the regiments of guards.

CAP-A-PEE, in *military antiquity*, implies being clothed in armour from head to foot.

CARABINE, in *military affairs*, is a fire-arm ſomewhat ſmaller than the firelocks of the infantry, and uſed by all the horſe. It carries a ball of 24 in the pound: its barrel is 3 feet long, and the whole length, including the ſtock, 4 feet.

Rifled-CARABINES, are generally of the ſame dimenſions with the above, the barrel of which is rifled ſpirally from the breech to the mouth. ſo that when the ball, which is forced into it, is driven out again by the ſtrength of the powder, it is lengthened about the breadth of a finger, and marked with the rifle of the bore. Fire-arms of this kind have a much greater range than any other, becauſe the riſe of the barrel impedes the ball, which by that means makes the greater reſiſtance at the firſt inflammation of the powder, giving time for the whole charge to take fire, before the ball is out of the bore. Theſe arms are uſed by the hunters, or light infantry.

CARABINEERS, or *Carbineers*. All regiments of light-armed horſe were formerly called ſo; but ſince the forming of huſſars and chaſſeurs, they have loſt that denomination; and now all the foreign heavy cavalry are called carabineers.

CARCASS, in *military affairs*, are of two ſorts, oblong and round: the uncertain flight of the firſt ſort has almoſt rendered them uſeleſs.

leſs. They are prepared in the following manner: boil 12 or 15lb. of pitch in a glazed earthen pot; mix with that 3 lb. of tallow, 30lb. of powder, 6lb. of ſalt-petre, and as many ſtopins as can be put in. Before the compoſition is cold, the carcaſs muſt be filled; to do which, ſmear your hands with oil or tallow, and fill the carcaſs ½ full with the above compoſition; then put in loaded pieces of gun or piſtol barrels, loaded grenades, and the intervals with compoſition; and cover the whole over with coarſe cloth, well ſewed together, keeping it in a round form. Then put it into the carcaſs, having a hollow top and bottom, with bars running between them to hold them together, and compoſed of 4 ſlips of iron joined at top, and fixed at the bottom, at equal diſtances, to a piece of iron, which, together with the hoops, when filled, form a complete globular body. When quite finiſhed and cold, it muſt be ſteeped in melted pitch, and then inſtantly immerged in cold water. Laſtly, bore 3 or 4 holes at top, and fill the ſame with fuze compoſition, covering the holes with pitch until uſed. They are thrown out of mortars, and weigh from 50 to 230lb. according to the ſize of the mortars they are thrown out of. There are other carcaſſes for the ſea-ſervice, which differ from a ſhell only in the compoſition, and the 4 holes from which it burns when fired.

Carcasses were firſt uſed by the biſhop of Munſter, at the ſiege of Groll in 1672, where the duke of Luxembourg commanded.

CARRIAGES, in *military affairs*, are of various kinds, viz.

Garriſon-Carriages, are thoſe on which all ſorts of garriſon pieces are mounted. They are made much ſhorter than field-carriages, and have generally iron trucks inſtead of wheels. Their dimenſions are all ſpecified in the following table, together with the names of every article thereto belonging. The dimenſions are expreſſed in inches and decimals, except the head column, which is the nature of the gun, from a 42 to a 3-pounder. The arms of the hind axle-tree, having the ſame dimenſions as thoſe of the fore ones, are omitted, as alſo the height behind the ſide pieces. See Pl. VI. fig. 2.

Nature of the gun		42	32	24	18	12	9	6	3
Width incloſed	before	18	18	16.5	15.5	14	13	11.5	9
	behind	23.5	23.5	22.5	21.5	19.5	18.5	16.5	12.5
Fore axle-tree length		57	57	54.5	54.5	45.5	42.5	38.8	32.5
Body	length	35.4	36.6	34.9	33.1	29.5	27.5	24.8	19.5
	height	10.8	10.8	10.	10	10	9.5	9.	8.3
	breadth	6.8	6.8	6.8	6	5.5	5.2	5.	4
Arms	length	10.8	10.2	9.8	9.2	8	7.5	7	5.3
	diameter	6.2	6.2	6.2	5.8	5.2	5	4.5	3.5
Hind axle-tree length		57	57	54	51.5	45.5	42.5	38.8	32.5
Body	length	35.4	36.6	34.9	33.1	29.5	27.5	24.8	19.5
	height	6.8	6.8	6.8	6	5.5	5.2	5	4.
	breadth	12	12	12	12	12	12	12	12.
Fore-trucks	diameter	19	19	18	18	16	16	14	14
	breadth	6.5	6.5	5.5	5	4.5	4	3.5	3
Hind-trucks	diameter	16	16	16	15	14	14	12	10.
	breadth	6.5	6	5.5	5	4.5	4	3.5	3
Side-pieces	height before	26.8	26.2	26.	23.6	20	18.8	16	13.6
	length	78	78	72	69	66	63	60	37.5
	breadth	6.5	6.	5.5	5	4.5	4	3.5	3.
Trunions from the head		8	8	8	8	6.8	6.6	6.6	6

Names of all the iron-work of a garriſon-Carriage, *together with the quantity of each ſort.*

Cap-ſquares	2
Eye-bolts	2
Joint-bolts	2
Tranſom-bolt	1
Bed-bolt	1
Bracket-bolts	2
Hind axle-tree bolts	4
Burs	2
Loops	6
Dowel-pins	4
Square riveting-plates	8
Rings and keys	10
Traverſing-plates	2
Linch-pins	4

Axle-

Axle-tree hoops - - -	2
Axle-tree ſtays - - -	2
Keys, chains, and ſtaples -	2
Stool-bed bolts, &c. - -	2

N. B. As the trucks of garriſon-carriages are generally made of caſt-iron, their axle-trees ſhould have copper clouts underneath, to diminiſh the friction of the iron againſt the wood. Travelling-carriages are in many reſpects very unfit for garriſon ſervice, though frequently uſed.

Travelling-CARRIAGES, are ſuch as guns are mounted on for ſieges, and for the field: they are much longer, and differently conſtructed from garriſon-carriages; having 4 wheels, 2 for the carriage, and 2 for the limber, which laſt are only uſed on marches. The names and dimenſions of each part are ſpecified in the following tables.

Cheeks.

Nature of the guns		24	18	12	6	3
Length of the cheeks in feet		13.	12.5	12	11	10
Thickneſs of the cheeks in inches and decimals		5.8	5.2	4.6	3.6	3.
Height of the plank		22	21.6	19	16	13
Height of the cheek	before	20	19.6	17	14	11.5
	centre	17	16.6	15	10	9.5
	trail	12	11.6	11	10	7.5
Head from the centre		74	72	69	60	5.5
Length of the trail		18	16.6	15	12	10

Of the axle-trees.

Nature of the guns		24	18	12	6	3
Body	length	38.5	38.8	39.	40	40.5
	breadth	7	7.8	6.5	6	5.5
	height	9	9.8	8.5	8	7.5
Arms	length	21	20.8	20.5	19	17.5
	body diameter	7	6.8	6.5	6	5.5
	linch diameter	5	4.8	4.5	4	3.5
Total length		81	80.5	80	78	76

Of the wheels.

Calibers, or nature of the guns		24	12	6	3	parts
Wheels diameter		58	58	58	58	
Nave length		17.5	17	15.5	12.5	76
Diameter	body	15	15	13	12.5	62
	middle	16	16	14	13	74
	linch	13.5	13.5	10	10	60
Fellies	thickneſs	5	4.5	4	3	22
	breadth	6.5	6	5.5	5	28
Spokes	thickneſs	2.3	2.2	2.	2	10
	breadth	4.5	4	3.5	3	0

N. B. The explanation of this table is as the former, except the laſt column, which expreſſes general dimenſions, taken from the diameter of the ſhot, divided into 24 equal parts; a method by which all the dimenſions of both guns and carriages ſhould be regulated.

Names and quantity of the iron-work of a Travelling-Carriage.

Tranſom-bolts, with burs	breaſt	1
	centre	2
	trail	2
Tranſom-plates, with hooks	breaſt	2
	centre	2
	trail	2
Trunnion-plates		2
Cap-ſquares with joint-bolts		2
Spring-keys, with chain and ſtaples		4
Eye-bolts	fore.	2
	hind	2
Single forelock keys		8
Bed piece, chain and ſtaple		1
Locker	hinges	2
	haſp with ſtaples	1

Wood

Wood ſcrews		
Plates, with roſes	garniſh	2
	trail	2
Breaſt-plates		2
Garniſh	bolts	2
	nails	6
Axle-tree-bands		2
Side-ſtraps		4
Draught-rings, with bolts and burs		2
Locking-plates		2
Laſhing rings and loops		8
Nails	roſe-buds	4
	diamond-headed	8
	counterſunk	
	trail	26
Pintle-plates		2

Names and quantity of all the parts of a wheel and iron-work.

Nave	1
Spokes	12
Fellies	6
Dowel-pins	6
Streaks	6
Streak-nails	36
Nave-boxes	2
Dowledges	6
Nave-hoop-ſtubs	9
Box pins	6
Rivets for the dowledges	24
Nave hoops	3

Names and quantity of iron-work of an axle-tree.

Axle-tree-bar		1
Clouts	body	2
	linch	2
Axle-tree-hoops	linch	2
	arms	2
	body	2
Hurters with ſtraps		2
Waſhers		2
Linch-pins		2
Axle-tree-bolt		1
Single forelocks		2
Clout-nails		12
Dog-nails		8
Axle-tree-hoops		2

N. B. The dimenſions of carriage limbers will be mentioned in the article *Field*-CARRIAGES, as they are the ſame with travelling carriages.

Field CARRIAGES, are both ſhorter and lighter than thoſe before mentioned, bearing a proportion to the pieces mounted thereon: the names and dimenſions of every part are ſpecified in the following tables. See Pl. VII. fig. 1 and 2.

Calibres		24	12	6	parts
Cheeks	length	108.	106.	94.	13.4
	height	15.6	14.	12.4	3.6
	thickneſs	4.5	3.7	3.	0.18
Cheeks	height before	14.5	12.7	11.	2.18
	at the centre	12.	10.9	9.8	2.16
	at the trail	10.	9.2	8.	1.16
Length of the trail		11.	10.5	10.	1.22
From head to centre		50.	45	40.	11.6
Width	before	11.5	10.7	10.	2.1
	behind	17.	15.	13.	2.15
Lockers	length	——	——	23.	
	breadth	——	——	13.3	
	depth	——	——	4.3	
Length of the trail hand-ſpike		63.	60.	57.	
Diameter at the trail of ditto		4.	3.5	3.	
Screw for elevation	handles in length	——	5.	4.	
	height	——	10.5	9.	
	diameter	——	2.	1.5	
	diameter of ſocket	——	3.	2.5	
Wheels height		50.	50.	50.	45.
Nave length		15.	13.	12.7	3.
Wheels diameter	body	13.	11.	10.6	2.10
	middle	14.	12.	11.6	2.15
	linch	12.	11.	10.	2.5
Fellies	height	4.7	4.	3.6	1.
	breadth	3.3	2.8	2.4	0.16
Spokes	breadth	2.	1.8	1.7	0.9
	thickneſs	3.5	3.2	2.9	0.17

Limbers, are two-wheel carriages, ſometimes made with ſhafts, and ſometimes with beams for drawing double: they ſerve to ſupport the trail of *field-carriages*, by means of the pintle or iron bolt, when artillery is tranſported from one place to another; and are taken off again when the pieces are to be fired, unleſs upon a march, when harraſſed by the enemy, &c. Their conſtruction is in the following tables. See Pl. VII. fig. 3 and 4.

Calibres		24	12	6	3	parts
Nave	length	48.	48.	48.	4[illegible]	
	diameter of the body	16.	15.	14.	10.	
	——— middle	14.	14.	13.	12.5	2.15
	——— linch	12.	12.	11.	10.	2.10
Fellies	breadth	4.5	4.	3.5	3.	0.20
	height	5.	4.5	4.	3.5	
Spokes	breadth	1.8	1.6	1.4	1.2	0.9
	thicknefs	4.	3.5	3.	2.5	0.19
Body	length	40.	40.	40.	43.	
	height	7.6	7.	6.	5.5	
	breadth	6.	5.5	5.	5.	
Arms length		19.	18.	17.	13.	
Diameters	body	5.	4.	4.	4.	0.23
	linch	4.	3.	3.	3.	0.19
Shafts length		94.	94.	94.	94.	
Breadth	hind end	6.	5.5	5.	4.	1.5
	fore end	3.	3.	2.5	2.5	0.15
Height	hind end	3.3	3.	3.	3.	0.16
	fore end	3.	3.	2.5	2.5	0.15
Beams	length	110.	110.	110.	110.	
	breadth, hind end	4.5	4.	3.5	3.	
	———, fore end	4.	3.5	3.	2.5	
Bolfter	height	12.5	10.	8.	7.	
	length	36.	36.	36.	36.	
	breadth	6.	5.5	5.	5.	1.4
Fore crofs-bar	breadth	4.5	4.	3.5	3.	0.20
	height	1.5	1.5	1.5	1.5	
Hind crofs-bar	breadth	3.5	3.5	3.5	3.5	0.16
	height	1.5	1.5	1.5	1.5	
Axle-tree from the fore crofs-bar		11.5	11.5	11.5	11.5	2.1

Names of all the iron-work of the ſhafts and beams of limbers, with the quantity of each ſort.

Limber-bolt	1
Shaft-rings	2
Shaft-pins with chains	2
Ridge-chain hook and loop	1
Limber-chain hook and rings	1
Breech-hooks	2
Single forelock-keys	4
Nails, diamond-headed	8
Dog-nails	6
Bolſter-hoops	2
Pintle	1
Pintle-waſhers and plates	2

N. B. The iron-work of the wheel and axle-tree are the ſame as mentioned before, under the articles *wheels*, *axle-trees*, and under the general term CARRIAGES.

Galloper-CARRIAGES, ſerve for 1½-pounders. Theſe carriages are made with ſhafts, ſo as to be drawn without a limber. In the laſt war the king of Pruſſia mounted light 3-pounders on theſe carriages, which anſwered very well. Their dimenſions are

		feet	inch.	part
Total length of the ſhafts		11		27
From the	fore end to the fore crofs-bar	6	4.	16
	hind end to the round part	5		11
Height at the	hind end		6.	3.10
	fore end		3.	3
Breadth	behind and before		3.5	8.15
	in the middle		4.5	9.
Width within behind		2	6.5	7
At the fore	crofs-bar	2	4.	7.10
	end	2	1.	7.
From the hind end to the axle-tree			11.	3
Crofs-bar from the hind end			3.	12
Length of the checks		4	2.	11
Breadth of the fore checks			2.5	1
Width within	before		8.	2
	behind		11.5	1.20
Height of the checks			6.5	1.15
Total length of the axle-tree		6	4.	18
Length of the	body	3	6.5	
	arms	1	4.6	
Breadth of the body			5.	
Height of ditto			6.	
Greateſt diameter of the arms			5.	
Leaſt diameter of ditto			3.3	
Diameter of the wheels		4	3.	13.5
Nave length		1	1.	4.5
Diameters	body		11.	3
	middle	1		3.5
	linch		10.	2.20
Spokes	breadth		1.5	[illegible]
	thicknefs		3.	1.
Fellies	breadth		3.	1.
	height		4.5	1.10

N. B. The

N. B. The dimenſions, not inſerted here, may be taken from the draughts, where they are all mentioned, as likewiſe the iron-work.

Howitz-CARRIAGES, are for tranſporting howitzers; and thoſe for the 6 and 5.8-inch howitzers are made with ſcrews to elevate them, in the ſame manner as the light 6-pounders; for which reaſon they are made without a bed, and the centre tranſom muſt be 9 inches broad to fix the ſcrew, inſtead of 4 for thoſe made without: in the centre, between the trail and centre-tranſom, there is a tranſom-bolt, which is not in others, becauſe the centre-tranſom muſt be made to be taken out; after which the howitzer can be elevated to any angle under 90 degrees. Their dimenſions are as follow:

Length of the cheeks		8	5.	6.
Thickneſs of the cheeks			4.5	8.
Height of the cheeks before		1	6.	1.8
——— at the centre		1	4.	1.
——— at the trail		1	2.	.17
Length of the trail		1	3.	1.
Height of the plank		1	6.	
From the head to the centre		3	7.	
Trunnion-holes from the head			9.	.15
Breaſt-tranſom	length	1	2.5	.21
	height		2.	
	thickneſs		4.5	.9
Centre-tranſom	length	1	4.	1.3
	height		2.5	
	thickneſs		4.5	.10
Trail-tranſom	length	1	7.	1.5
	height	1	3.	
	thickneſs		4.5	.23

The iron-work of theſe carriages is the ſame as in the field-carriages (which ſee) except that here are only 4 garniſh-nails, 2 on each ſide: the cheeks, being ſo ſhort, will admit of no more. The wheels and axle-trees are the ſame as in the 18 and 12-pounder carriages.

Tumbrel-CARRIAGE. See TUMBREL.

Block-CARRIAGE, is purpoſely for conveying mortars and their beds from one place to another; the dimenſions of which are as follow:

		inch.
Fore-wheel height		48
Nave length		15
Diameters	body	14
	middle	15
	linch	13
Fellies	height	5.5
	breadth	3.5
Spokes	breadth	2
	thickneſs	3
		Inch.
Hind-wheels height		60
Nave length		17
Diameters	body	14
	middle	15
	linch	13
Fellies	height	6.5
	breadth	4
Spokes	breadth	2.3
	thickneſs	4
Fore axle-tree total length		77
Body	length	39
	breadth	6.5
	thickneſs	8
Arms length		19
Diameters	body	6
	linch	4
Bolſter	length	49
	breadth	6.5
	height	7
Hind axle-tree total length		77
Body	length	37
	breadth	7
	height	8.7
Arms length		20
Diameters	body	6.4
	linch	4.8
Bolſter	length	47
	breadth	7
	height	8
Side-pieces	length	132
	breadth	6.5
	height	6.5
Diſtance between the axle-trees		
Side-pieces project equally by		
Shafts length		96
Length of the ſtrait-bar		19
Shafts breadth	behind	5.3
	middle	6
	before	3
Opening of the ſtrait bar	behind	28.5
	middle	32.5
	before	24
Height of the ſhafts		5
Rider	length	46
	breadth	6.5
	height	8
Interval between the ſide-pieces		12
Side-pieces are let into the rider and hind-bolſter.		2

Truck-CARRIAGES, are to carry timber and other heavy burthens from one place to another, at no great diſtance: they ſerve alſo to convey guns or mortars upon a battery, where their own carriages cannot go, and are drawn by men as well as horſes. Their dimenſions are as follow:

		Inch.
Fore axle-tree	body length	32
	breadth	5
	height	11
	arms length	6.5
	diameter	3
Hind axle-tree	body length	32
	breadth	6
	height	7.5
	arms length	6.5
	diameter	3
Side-pieces	length	100
	breadth	10
	height	2.5
	interval	10
	to the fore axle-tree	15
	to the hind axle-tree	15
Fore-bolſter	length	32
	breadth	5
	height	6
Hind-bolſter	length	32
	breadth	6
	height	8
Shafts	length	96
	height	3.3
Opening	near the bolt	23
	middle	35
	before	24
Breadth	before	3
	middle	4
	at the bolt	3.5
From the end to the ſtrait croſs-bar		12
Fore-guide	length	30
	breadth	21
	height	4
	interval	10
Trucks	diameter	23
	thickneſs	4

The croſs piece fixed upon the fore ends of the ſide pieces, is 5 inches broad, 3 high before, and 1.5 behind. The croſs piece behind the fore bolſter and the ſide pieces, is 10 inches broad, and 1.5 thick. The bolſters are let into the ſide pieces about 3-4ths of an inch. The iron-work is ſo diſtinctly ſeen in the plan and elevation of the carriage, that it would be needleſs to mention it.

Ponton-CARRIAGE. Carriages of this kind are ſolely for tranſporting the pontons: they had formerly but two wheels, but are generally now made with four. The making uſe of two-wheel carriages for travelling a great way, is contrary to ſenſe and reaſon; becauſe the whole weight lying upon the two wheels, muſt make them ſink deeper into the ground, than thoſe of a four-wheel carriage. Their dimenſions are as follow:

		Inch.
Wheels diameter, both behind and before		63
Nave length		15
Diameters	body	14
	middle	15
	linch	12
Fellies	breadth	4
	height	4.5
Spokes	breadth	2
	thickneſs	3.5
Axle-tree length		88
Body	length	46
	breadth	6
	height	8.5
Arms length		18
Diameter	body	6
	length	3.8
Side-pieces	under	210
	upper	206
Under ſide-pieces	breadth	7
	height	6
Upper ſide-pieces	breadth	5
	height	2.6
Fore and hind croſs-bars	breadth	6.5
	height	3.5
	length	52
Centre of the fore axle-tree diſtant from the fore end		10
Centre of the hind axle-tree diſtant from the hind end		93
Opening between the	upper ſide-pieces	51
	under ſide-pieces	18
Fore ſupporter, diſtant from the fore end		45
Hind ſupporter, diſtant from the hind end		[illegible]
Height of the ſupporters		12

CAROUSAL, in *military hiſtory*, ſignifies a magnificent entertainment, exhibited by princes or other great perſonages, on ſome public occaſion; conſiſting of cavalcades of gentlemen richly dreſſed and equipped, after the manner of the ancient cavaliers divided into ſquadrons, meeting in ſome public place, and performing jeſts, tournaments, &c.

To CARRY *on the trenches*. See TRENCHES.

CART, in a *military ſenſe*, is a vehicle mounted on two wheels, and drawn by one or more horſes; of which there are ſeveral ſorts, viz.

Powder-CARTS, are for carrying powder with the army: they are divided into 4 parts, by boards of an inch thick, which enter about an inch into the ſhafts. Each of theſe carts can only ſtow 4 barrels of powder. The roof is covered with an oil-cloth, to prevent dampneſs from coming to the powder, and their dimenſions are as follow :

		inch.
Wheels diameter		65
Sides and ſhafts total length		180
From the hind	end to the croſs-bar	5.5
	croſs-bar, to the fore croſs-bar	88.5
From the fore croſs-bar to the fore end		77.5
Breadth	behind	3.3
	fore croſs-bar	4.4
	middle	3.7
	before	2.8
Height	behind	3
	fore croſs-bar	4
	before	2.8
Opening behind, and at fore croſs-bar		34
Two-ſhaft croſs-bars	length	34
	breadth	2
	height	3
Under croſs-bars	length	40
	breadth	3
	height	2
Side-pieces	length	100
	breadth	13
	height	3
Axle-tree paſſes through the ſide-pieces from the bottom		3
From the ſhaft to the beginning of the roof		6
Height of the roof		12
Sides	length	88
	breadth	10
	thickneſs	1
Roof-ſides	length	83
	breadth	11
	thickneſs	1
Opening at the middle of the croſs-bar		35
Opening before, and at the hind croſs-bar.		25

The *iron-work* is as follows :

Side-bolts with ſcrews	8
Croſs-bolts with ſingle keys	2
Double hinges for the ſhort lids	6
Staples with keys and chains	4
Hinges for roof lids	2
Haſps, ſtaples, and keys for ditto	3
Axle-tree pins with keys	2

Complete iron for ſhafts, wheels, and axle-trees. See TUMBREL and *Travelling*-CARRIAGE.

Sling-CARTS, are uſed to carry mortars or heavy guns from one place to another, at a ſmall diſtance, but chiefly to tranſport guns from the water-ſide to the proof-place, and from thence back again; as alſo to convey artillery to the batteries in a fortification, &c. Their dimenſions are as follow :

		inch.
Wheels height		60
Naves length		15.5
Diameter	body	14
	middle	16
	linch	12
Fellies	breadth	3.4
	height	5.5
Spokes	breadth	2
	thickneſs	3
Axle-tree length		77.5
Body	length	40.5
	breadth	5.
	height	5.5
Arms length		18.5
Diameter	body	5
	linch	4
Shafts total length		168
From the centre of the axle-tree to the fore end		144
Breadth	from the hind end to the croſs-bar	7
	middle	5.5
	fore end	3.4
Opening	axle-tree & fore croſs-bar	23
	middle	30
	before	24
Height of the ſhafts		3.6
Croſs-bars	breadth	4
	thickneſs	2
Cheeks to ſupport the roller	length below	28
	above	7
	height	9
	thickneſs	4
	interval	32
Diameter of the roller		7
From the centre of the axle-tree to the fore end		24

Iron-work of a Sling-CART, is as follows :

Croſs-bars	2
Round-headed nails to faſten the croſs-bars	4
Bolts with ſcrews to faſten the cheeks	7

Wheels and ſhafts complete.

CARTEL, in *military tranſactions*, an agreement between two ſtates at war for the exchange of their priſoners of war.

CARTE-BLANCHE, in *military affairs*, ſignifies an unlimited power to act to the beſt of one's judgement. It likewiſe ſtrictly means a blank paper; a paper to be filled up with ſuch conditions as the perſon to whom it is ſent thinks proper.

CARTOUCH, in *military affairs*, is a caſe of wood about 3 inches thick at bottom, bound about with marline, holding about 400 muſket-balls, beſides 8 or 10 iron balls of a pound each, to be fired out of a howitzer, for the defence of a paſs, &c. See GRAPE-SHOT.

CARTRIDGE, a caſe of paper, parchment, or flannel, fitted to the bore of the piece, and holding exactly its proper charge. Muſket and piſtol cartridges are always made of ſtrong paper, between 30 and 40 of which are made from 1 pound of powder, including their priming. Cannon and howitzer cartridges are ſometimes made of parchment, though more generally of flannel: the charges they contain are adapted to the ſervice they are intended for.

CARTRIDGE-*box*, a caſe of wood, made in a circular form, to wear before the body of the ſoldier, holding 24 muſket-ball cartridges in two rows: it is covered with leather, and worn upon a belt, both on duty, and on the day of battle. See POUCH.

CASCABLE, in *artillery*, is the very hindermoſt knob or button of the cannon, or the utmoſt part of the breech. See CANNON.

CASCANS, in *fortification*, holes in the form of wells, ſerving as entrances to galleries, or giving vent to the enemy's mines. See [illegible].

CASEMATE, in *fortification*, a vault, or arch of maſon work, in that part of the flank of a baſtion which is next the curtain, made to defend the ditch, and the face of the oppoſite baſtion. See FORTIFICATION.

CASERNES, in *fortification*, are buildings for the ſoldiers of the garriſon to live in; generally erected between the houſes of fortified towns, and the rampart.

CASE-*Shot*. See SHOT, and LABORATORY.

CASSINE, in *military hiſtory*, ſignifies a ſmall houſe in the country, generally ſurrounded with a ditch: they are very convenient to poſt ſmall parties in, where they will be ſheltered from any ſudden attack, and can even make head 'till the neareſt detachments can come and relieve them.

CASSIONS, cheſts filled with ſhells, and placed under ground, and fired: they are generally made to contain from 4 to 20 loaded ſhells, according to the execution they are to do. Their effects are more tremendous than mines.

CASTING, in *founding guns*, implies the operation of running any ſort of metal into a mould prepared for that purpoſe.

CASTLE, in *military affairs*, a fortified place, or ſtrong hold, to defend a town or city from an enemy. Caſtles are for the moſt part no higher in antiquity than the Conqueſt; or rather about the middle of king Stephen's reign. Caſtles were erected in almoſt all parts of the kingdom, by the ſeveral contending parties; and each owner of a caſtle was a kind of petty prince, coining his own money, and exerciſing ſovereign juriſdiction over his people. Hiſtory informs us that 1017 caſtles were built in this reign.

CATATROME. See CRANE.

CATAFALCO, in *military architecture*, a ſcaffold of timber, decorated with ſculpture, painting, &c. for ſupporting the coffin of a deceaſed hero, during the funeral ſolemnity.

CATAPULTA, in *military antiquity*, an engine contrived for the throwing of arrows, darts and ſtones, upon the enemy. Some of theſe engines were ſo huge, and of ſuch force, that they would throw ſtones, of an hundred weight. Joſephus takes notice of the ſurpriſing effects of theſe engines, and ſays, that the ſtones thrown out of them beat down the battlements, knocked off the angles of the towers, and had force ſufficient to level a very deep file of ſoldiers.

CATTUS, } in *ancient military hiſtory*, was
CATHOUSE, } a kind of covered ſhed, ſometimes fixed on wheels, and ſimilar to the *Vinea* and *Pluteus* of the ancients.

CAVALCADE, in *military hiſtory*, implies a pompous proceſſion of horſemen, equipages, &c. by way of parade, to grace a triumph, public entry, or the like.

CAVALIER, in *fortification*, is a work generally raiſed within the body of the place, 10 or 12 feet higher than the reſt of the works. Their moſt common ſituation is within the baſtion, and made much in the ſame form: ſometimes they are placed in the gorges, or on the middle of the curtain; they are then made in the form of a horſe-ſhoe. See FORTIFICATION. Their uſe is to command all the adjacent works and country round about it: they are ſeldom or never made but when there is a hill or riſing ground, which overlooks ſome of the works.

Trench-CAVALIER, in the *attacks*, is an elevation which the beſiegers make by means of earth or gabions, within half-way, or two thirds of the glacis, to diſcover, or to enfilade the covert way.

CAVALRY, in *military affairs*, that body of ſoldiers that ſerves and fights on horſeback: under this denomination are included, viz.

Horſe, that is, regiments or troops of horſe. In England there are, the horſe-guards, commonly called the *firſt and ſecond troops of horſe-guards*; the *firſt and ſecond troops of grenadier-guards*; the *royal regiment of horſe-guards*. And in Ireland there are four regiments of horſe-guards. The firſt troop of horſe was raiſed in 1660.

Dragoons, are likewiſe regiments of horſe, but diſtinguiſhed from the former by being obliged to fight both on foot and on horſeback. In England there is the firſt, or king's regiment of dragoon-guards; the ſecond, or queen's regiment of dragoon-guards; the third, or prince of Wales's regiment of dragoon-guards. Likewiſe, the firſt, or royal regiment of dragoons; the ſecond, or royal North-Britiſh dragoons; the third, or king's own regiment of dragoons: beſides, the royal Iriſh dragoons, Inniſkilling regiment of dragoons, queen's regiment of dragoons, prince of Wales's regiment of dragoons, with 10 more regiments of dragoons. The firſt regiment of dragoons was raiſed in 1681.

Hunters. See LIGHT-HORSE.

Light-horſe, are regiments of cavalry, mounted on light, ſwift horſes, whoſe men are but ſmall, and lightly accoutred. They were firſt raiſed in the laſt war, in 1757.

Huſſars, generally Hungarian horſe. Their uniform is a huge furred cap, adorned with a cock's feather; thoſe of the officers, either with an eagle's or a heron's; a very ſhort waiſtcoat, with a pair of breeches and ſtockings in one; ſhort light boots, generally of red or yellow leather; with a curious doublet, having five rows of buttons, which hang looſely on the left ſhoulder. Their arms are a long crooked ſabre, light carbines, and piſtols. Before they begin an attack, they lay themſelves ſo flat on the necks of their horſes, that it is hardly poſſible to diſcover their force; but, being come within piſtol-ſhot of the enemy, they raiſe themſelves with ſuch ſurpriſing quickneſs, and fall on with ſuch vivacity, that it is very difficult for the troops to preſerve their order. When a retreat is neceſſary, their horſes have ſo much fire, and are ſo indefatigable, their equipage ſo light, and themſelves ſuch excellent horſemen, that no other cavalry can pretend to follow them: they leap over ditches, and ſwim over rivers, with a ſurpriſing facility. Moſt of the German powers have troops under this name, as alſo France.

CAVEATING, in *fencing*, implies a motion whereby a perſon in an inſtant brings his ſword, which was preſented to one ſide of his adverſary, to the oppoſite ſide.

CAVIN, in *military affairs*, implies a natural hollow, ſufficiently capacious to lodge a body of troops, and facilitate their approach to a place. If it be within muſket-ſhot, it is a place of arms ready made, and ſerves for opening the trenches, free from the enemy's ſhot.

CAZEMATTE. See CASEMATE.

CAZEMATE, CASEMATE, in *fortification*, is a certain retired place in the flank of a baſtion, for the defence of the ditch, and the face of the oppoſite baſtion; not uſed at preſent. It alſo implies a well, having ſeveral ſubterranean branches, which are extended when they ſuſpect the enemy is forming a mine, 'till they hear the miners at work.

CAZERNS. See BARRACKS.

CENOTAPH, in *military hiſtory*, implies the empty tomb of a hero, or a monument erected to the honour of a perſon, without the body of the deceaſed being interred in or near it.

CENTRE, CENTER, in a *general ſenſe*, ſignifies a point equally diſtant from the extremities of a line, ſurface, or ſolid.

CENTRE *of a baſtion*, is a point in the middle of the gorge of the baſtion, from whence the capital line commences, and which is generally at the inner polygon of the figure.

CENTRE *of a battalion*, on parade, is the middle, where an interval is left for the colours; of an incampment, it is the main ſtreet; and on a march, is an interval for the baggage, &c.

CENTRE *of gravity*, in *military mechanics*, is that point about which the ſeveral parts of a body exactly balance each other in any ſituation.

CENTRE *of a conic-ſection*, is the point where all the diameters meet.

CENTRE *of an ellipſis*, is that point where the tranſverſe and conjugate diameters interſect each other.

CENTRE *of motion*, is that point which remains at reſt while all the other parts of the body move about it.

CENTRE *of percuſſion*, is that point in which the force of the ſtroke is the greateſt poſſible. When the moving body revolves round a fixed point, the centre of percuſſion is the ſame with the centre of oſcillation, and found by the ſame method: but when the body moves in a parallel direction, the centre of percuſſion is the ſame with the centre of gravity.

CENTINEL, CENTRY, is a private ſoldier, from the guard, poſted upon any ſpot of ground, to ſtand and watch carefully for the ſecurity of the ſaid guard, or of any body of troops, or poſt, and to prevent any ſurpriſe from the enemy. All centinels are to be very vigilant on their poſts; neither are they to ſing, ſmoke, or ſuffer any noiſe to be made near them. They are not to ſit down, lay their arms out of their hands, or ſleep; but keep moving about their poſts during the two hours they ſtand, if the weather will allow of it. No centry to move more than 50 paces to the right, and as many to the left of his poſt, and let the weather be never ſo bad, he muſt not get under cover. No one to be allowed to go from his poſt without leave of his commanding officer; and, to prevent deſertion or marauding, the centries and vedettes muſt be charged to let no ſoldier paſs.

CENTINEL *perdu*, a ſoldier poſted near an enemy in ſome very dangerous poſt, where he is in perpetual danger of being loſt.

CENTRY-*box*, a ſort of wooden box, or hut, to ſhelter the centinel from the injuries of the weather; but, in fortifications made of maſonry, they are made of ſtone, in a circular form.

CENTURY, in a *military ſenſe*, means a hundred ſoldiers, who were employed in working the battering-ram.

CESSATION, or *ceſſation of arms*, in a *military figurative ſenſe*, means a truce, or the total abrogation of all military operations for a limited time.

CHACE *of a gun*, generally means the whole length of it. See CANNON.

CHAFFERY, that part of a foundery where the forges are placed for hammering iron into complete bars, and thereby bringing it to perfection.

CHASSEURS. See HUNTERS.

CHAIN *for engineers*, is a ſort of wire chain divided into links of an equal length, made uſe of for ſetting out works on the ground, becauſe lines are apt to ſhrink and give way.

There are ſeveral ſorts of chains made uſe of in menſuration; as Mr. Rathbone's, of two perches in length; others one perch long; ſome of 1000 feet in length: but that which is moſt in uſe amongſt engineers is Mr. Gunter's, which is 4 poles long, and contains 100 links, each link being $7\frac{92}{100}$ inches in length.

CHAIN-*ſhot*. See SHOT.

CHALLENGE, a cartel, or invitation to a duel or other combat: it may with propriety be called a provocation, or ſummons to fight, when an affront in derogation of honour has been offered.

CHAMADE, in a *military ſenſe*, means a ſignal made by the enemy, either by beat of drum, or ſound of trumpet, when they have any matter to propoſe; ſuch as to bury their dead, &c. See PARLEY.

CHAMBER *of a cannon*, in *artillery*, that part of the bore of a cannon which receives the powder with which it is charged. See CANNON.

CHAMBER *of a mortar*, the ſpace where the powder lies, and generally of ſeveral forms and dimenſions, ſuch as the conic, ſpheric, cylindric, parabolic, and concave or bottled chambers. See MORTARS.

CHAMBER *of a mine*, that place where the charge of powder is lodged, to blow up the works over it. See MINE.

CHAMBER *of a battery*, is a place ſunk under ground for holding powder, loaded ſh[illegible] and fuzes, where they may be out of danger, and alſo preſerved from the rain.

CHANDELIERS, in *military affairs*, a kind of moveable parapet, conſiſting of wooden frames, on which faſcines are laid to cover the workmen when at work on the trenches. They are made of various ſorts and ſizes, according to the uſe they are for.

CHAPE, the metalline part put on the end of a ſcabbard, to prevent the point of the ſword from piercing through it.

CHARACTER, in a *general ſenſe*, implies any mark uſed for repreſenting either ideas or objects.

Military CHARACTERS, } are certain marks
Mathematical CHARACTERS, } invented for avoiding prolixity, and more clearly conveying the thoughts of the learned in thoſe ſciences to beginners; the chief of which are as follow:

+ in algebra is the ſign of the real exiſtence of the quality it ſtands before, and is called an affirmative, or poſitive ſign. It is alſo the mark of addition, and ſignifies that the numbers or quantities on each ſide of it are added together; as, if you ſee $a+b$, or $3+5$, it implies that a is added to b, or 3 added to 5. It ſtands for the word *more* alſo. Thus $5+4+7$ is read 5 *more* 4, *more* 7, *equal to* 16. So alſo $a+b+c+d$, ſhews that a, b, c, and d, are to be added together.

— This is the note of negation, negative exiſtence, or non-entity. It is the ſign of ſubtraction, and ſignifies that the numbers or quantities which come after it, are to be taken from the numbers or quantities which ſtand before it. Thus $a+b-c$, ſhews, that the quantity c is to be taken from the ſum of a and b. It ſtands for the word *leſs* alſo. Thus $9-5$, is read 9 *leſs* 5, which is 4; and $b-9$, is b *leſs* 9, and ſhews that 9 is to be taken from the quantity b, &c.

N. B. That + ſignifies a *poſitive* or *affirmative* quantity, or *abſolute* number; but — ſignifies a *fictitious* or *negative* number or quantity. Thus -8, is 8 times leſs than nothing. So that any number or quantity with the ſign + being added to the ſame number or quantity with the ſign —, their ſum will be equal to nothing. Thus 8 added to -8 is equal to 0, but -8 taken from $+8$, is equal to 16.

× is the ſign of multiplication. It ſignifies *into*, or *multiplied by*; thus $4 \times 5 \times 3$, ſhews, that 4 is to be multiplied by, or into 5, and their product, by or into 3. So alſo $a \times b \times c \times d$, ſhews the continual multiplication of a, b, c, and d.

N. B. When quantities are placed one after another, without any ſign or character, it ſhews their multiplication. Thus $a\,b$ is $a \times b$, &c.

÷ is the mark of diviſion, and ſignifies that the numbers or quantities before it are to be divided by the numbers after it. Thus $a \div b$, means that a is to be divided by b; ſo $16 \div 4$, ſhews that 16 muſt be divided by 4. There is a better way of expreſſing diviſion, and which is more frequently uſed; and this is by placing the dividend at top, and the diviſer underneath it. Thus a divided by b, is placed $\frac{a}{b}$; alſo 16 divided by 4, thus $\frac{16}{4}$, &c.

= are the ſigns of equality, and ſignify that the quantities and numbers on the one ſide of it are equal to the quantities and numbers on the other; as $a = b$, or $AB = CD$; that is, a is equal to b, and AB is equal to CD, &c.

$\surd$ is the ſign of radicality, and ſhews (according to the index of the power that is ſet over or after it) the ſquare, cube, or other root, is extracted, or is to be ſo, out of any quantity, as $\surd 16$, or $\surd^{2}\,16$, or $\surd(2)\,16$ is the ſquare root of 16. This character ſometimes affects ſeveral quantities, diſtinguiſhed by a line drawn over them thus, $\sqrt{b+d}$ denotes the ſquare root of the ſum of b and d. When any term or terms of any equation are wanting, they are generally ſupplied by one or more aſteriſms: thus in the equation.

$$\left.\begin{matrix} y^2+py+\frac{1}{4}p^2+q \\ -py-\frac{1}{2}p^2 \end{matrix}\right\} = 0,$$

the term py vaniſhing, is marked with an aſteriſm, as $y^2 * -\frac{1}{4}p^2 + q$.

$\overset{3}{\surd}$ is the ſign of the cube root, and ſignifies the extraction of it, as in the ſquare root above.

∺ is the ſign of continued or geometrical proportion: thus, $a ∺ b ∺ c$, &c. are quantities in geometrical proportion: but geometrical proportion is better expreſſed by one and the ſame quantity, with the ſign after them. Thus a, aa, aaa, $aaaa$, or a^2, a^3, a^4, a^5, — &c. are quantities in geometrical proportion. So alſo 2, 4, 8, 16, 32, 64 ∺, &c. and in continual proportion.

:: is the mark of geometrical proportion disjunct, and is uſually placed between two pair of equal ratio's; as $3 : 6 :: 4 : 8$, ſhews that 3 is to 6, as 4 to 8. Or $a : b :: d : e$, and are thus read, as a is to b, ſo is d to e, &c.

> or ⊏ are ſigns of majority; thus, $a > b$ expreſſes that a is greater than b.

< or ⊐ are ſigns of minority; and when we would denote that a is leſs than b, we write $a < b$, or $a \sqsupset b$, &c.

$\sqrt[3]{a \times b + c}$ ſignifies, that the product of a and b added to c is to have its cube root extracted. The ſame of the ſquare root.

$\sqrt{a \times b + c - d}$ ſhews, that after the quantity d is taken out of the product of a and b more the ſum of c, the remainder is to have its ſquare root extracted.

——— is often uſed to couple or link quantities together, for the better reading or underſtanding them. Beſides, they are differently expreſſed from what they are when it is wanting. Thus, $a \times b + c + d$ has quite a different ſignification from what it has with the daſh over it; thus, $a \times \overline{b+c+d}$; for $a \times \overline{b+c+d}$, ſignifies, that the quantity a is to be multiplied by the ſum of b, c, and d; whereas, without the daſh, it would ſignify only that the ſum of the quantities c and d is to be added to the product of a into b.

$\sqrt{m + \frac{hh}{4} + dd} - c$ ſignifies, that the quantity c is to be taken out of the ſquare root of $m + \frac{hh}{4} + dd$. But

$\sqrt{m + \frac{hh}{4}} + dd - c$ ſignifies, that only the ſquare root of $m + \frac{hh}{4}$ is to be extracted, and then the difference between the quantities $dd - c$ to be added to it. The ſame for the cube root.

± ſignifies *more* or *leſs ſuch a quantity*, and is uſed often in extraction of roots, completing of ſquares, &c.

Artillery-CHARACTERS, moſt generally uſed, are as follow:

C. qr. lb. which ſignifies centners or hundreds of 112 pounds, *qr.* quarters of 28 pounds, *lb.* pounds. Thus a piece of artillery with 4 : 3 : 16, is 14 hundred, 3 quarters, and 16 pounds.

Pr. ſignifies pounder. Thus 24 *pr.* is a 24-pounder.

T. C. qr. lb. ſignifies tuns, centners, quarters, pounds; and 28 *lb.* is one quarter, 4 *qr.* is one centner, or 112 pounds, and 20 *C.* is one tun.

lb. oz. dr. means, pounds, ounces, and drams: 16 *dr.* is one ounce, and 16 *oz.* is one pound.

lb. oz. dwt. gr. is pounds, ounces, pennyweights, and grains; of which 24 *gr.* make one pennyweight, 20 *dwt.* make one ounce, and 12 *oz.* one pound of troy-weight.

CHARACTERS *in fire-works are theſe following.*

M Means meal-powder.
϶ Corned powder.
ɵ Saltpetre.
Z Brimſtone.
C Z Crude ſulphur.
C + Charcoal.
C S Sea-coal.
B R Beech raſpings.
S × Steel or iron filings.
B × Braſs-duſt.
G × Glaſs-duſt.
T × Tanners duſt.
C I Caſt-iron.
C A Crude antimony.
⁎ Camphor.
A Y Yellow amber.
L S Lapis calaminaris.
ᘏ Gum.
B L Lamp-black.
G I Iſing-glaſs.
W Spirit of wine.
S T Spirit of turpentine.
P O Oil of ſpike.

CHARACTERS uſed in the arithmetic of infinites are dots over letters, denoting the character of an infiniteſimal, or fluxion. Thus the firſt fluxions of x, y, z, being marked thus, $\dot{x}, \dot{y}, \dot{z}$; the ſecond are $\ddot{x}, \ddot{y}, \ddot{z}$; and the third $\dddot{x}, \dddot{y}, \dddot{z}$.

Geographical CHARACTERS, are °, ′, ″, ‴, &c. which ſignify degrees, minutes, ſeconds, thirds. Thus 40°, 35′, 18″, 55‴, is read 40 degrees, 35 minutes, 18 ſeconds, 55 thirds. It is alſo uſed in the elevation of pieces of artillery.

CHARGE, in *gunnery*, implies the quantity of powder, ſhot, ball, ſhells, granadoes, &c. with which a gun, mortar, or howitzer, is loaded.

As pieces of artillery are of various denominations, and conſequently made uſe of on ſeveral occaſions, their charges thence muſt have many variations. I ſhall therefore endeavour to explain every kind of charge in the following tables, deducted from practice.

CHARGES *for heavy guns from a 42-pounder to a 3-pounder, both braſs and iron, in proof, ſervice, ſaluting, and ricochet.*

Natures	Proof		Service		Saluting	Ricochet
	Braſs	Iron	Braſs	Iron		
prs.	lb. oz.	lb. oz.	b. oz	b. oz	b. oz.	lb. oz.
42	31 8	25	14	12	10 4	3 4
32	26 12	21 8	10 10	9 4	8	2 14
24	21	18	8	8	6	2
18	18	15	6	8	4 8	1 12
12	12	12	4	4	3	1 6
9	9	9	3	3	2 8	1 4
6	6	6	2 8	2 8	2	1
3	3	3	1	1	12	6

CHARGES *for medium guns.*

	Proof		Service		Saluting	Ricochet
	Braſs	Iron	Braſs	Iron		
prs.	lb. oz.	lb. oz	lb. oz.	lb. oz.	lb. oz.	lb. oz.
24	18	18	8	8	4	1 12
12	9	9	3 8		2 8	1 4
6	6	6	2	2 4	1 4	12
3	3	3	1	1	14	8

CHARGES *for light guns.*

	Proof		Service		Saluting	Ricochet
	Braſs	Iron	Braſs	Iron		
prs.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.	lb. oz.
24	10	5	5		4	1 12
12	6		3		2 8	1 4
6	3		1 8		1 4	12
3	1 8	1 12	12		14	8

CHARGED *cylinder*, in *gunnery*, implies that part of the chace of a gun, which contains the powder and ball.

CHART, or *ſea*-CHART, is a hydrographical map, or a projection of ſome part of the earth's ſuperficies in plano, for the uſe of navigators and geographers.

Plane-CHART, is a repreſentation of ſome part of the ſuperficies of the terraqueous globe, in which the meridians are ſuppoſed parallel to each other, the parallels of latitude at equal diſtances, and conſequently the degrees of latitude and longitude every where equal to each other.

CHART *of reduction*, is that where the meridians are repreſented by right lines, inclining towards each other: thence it appears by conſtruction, that theſe charts muſt correct the errors of the plane ones. But ſince theſe parallels ſhould cut the meridians at right angles, and do not, they are defective, inaſmuch as they exhibit the parallels inclined to the meridians.

Mercators-CHART, is that where the meridians are ſtrait lines parallel to each other, and equidiſtant: theſe parallels are alſo ſtrait lines, and parallel to each other; but the diſtance between increaſes from the equinoctial towards each pole, in the ratio of the ſecant of the latitude to the radius.

Globular-CHART, a meridional projection, wherein the diſtance of the eye from the plane of the meridian, upon which the projection is made, is ſuppoſed to be equal to the ſine of the angle of 45°. This projection comes the neareſt of all to the nature of the globe, becauſe the meridians therein are placed at equal diſtances.

Chorographic-CHARTS, are deſcriptions of particular countries.

Heliographic-CHARTS, deſcriptions of the body of the ſun, and of the maculæ or ſpots obſerved in it.

Selenographic-CHARTS, particular appearances of the ſpots of the moon, her appearance and maculæ.

CHASE *of a gun*. See CHACE.

To CHASE *the enemy*, means to march after them on horſeback in full ſpeed. To purſue a ſhip at ſea.

CHAUSSE, or *Res de* CHAUSSE, an old expreſſion for the level of the field, or the plain ground.

CHAUSSE-*traps*. See CRAWS-FEET.

CHEEKS *of a gun-carriage*. See CARRIAGE.

CHEEKS *of a mortar-bed*. See BED.

CHEEKS *of a waggon*. See WAGGON.

CHEMIN-*Couvert*. See COVERT-WAY.

CHEMIN *des rondes*, in *fortification*, a ſpace between the rampart and low parapet under it, for the rounds to go about it.

CHEMISE, in *fortification*, a word almoſt out of uſe, the wall with which a baſtion, or any other work of earth, is lined for its greater ſupport and ſtrength: or it is the ſolidity of the wall from the talus to the ſtone-row.

CHEMISTRY, the art of examining bodies, and of extracting from them any of their component parts.

CHEVALIER, in a *general ſenſe*, ſignifies a knight or horſeman.

CHEVALER, in the manege, is ſaid of a horſe when, in paſſing upon a walk or trot, his off fore leg croſſes the near fore leg every ſecond motion.

CHEVAUX-*de-friſe*, in *fortification*, a large joiſt or piece of timber, about 5 or 6 inches ſquare, and 10 or 12 feet in length; into the ſides whereof are driven a great number of wooden pins, about 6 feet long, and 1½ inch diameter, croſſing one another at right angles, and pointed with iron. They are uſed on numberleſs occaſions, as to ſtop up the breaches, to ſecure the avenues of a camp from the inroads both of horſe and foot. They are ſometimes mounted on wheels, with artificial fires, to roll down in an aſſault, &c. They were firſt uſed at the ſiege of Groningen, in 1658.

CHEVRETTE, a kind of gin. Among the many inventions for raiſing guns or mortars into their carriages, this engine is very uſeful: it is made of two pieces of wood about 4 feet long, ſtanding upright upon a third, which is ſquare: they are about a foot aſunder, and parallel; pierced with holes oppoſite one another, to hold a ſtrong bolt of iron, which may be raiſed higher or lower at pleaſure: it may be uſed with a hand-ſpike, which takes its poiſe over this bolt, to raiſe any thing by force.

CHOROGRAPHY, in *engineering*, is the art of making a drawing or map of a country, province, or diſtrict.

CIMETER, See SIMITAR.

CINQUAIN, in *ancient military hiſtory*, was an order of battle, to draw up 5 battalions, ſo that they may make 3 lines; that is, a van, main-body, and reſerve. Suppoſing the 5 battalions to be in a line, the 2d and 4th advance and form the van, the 3d falls back and forms the rear, the 1ſt and 5th form the main body upon the ſame ground. Laſtly, every battalion ought to have a ſquadron of horſe on both the right and left wings. Any number of regiments, produced by multiplying by 5, may be drawn up in the ſame manner; as $10\times5=50$. $15\times5=75$. $20\times5=100$, &c.

CIRCUMVALLATION, or *line of circumvallation*, in *military affairs*, implies a fortification of earth, conſiſting of a parapet and trench, made round the town intended to be beſieged, when any moleſtation is apprehended from parties of the enemy, which may march to relieve the place.

Before the attack of a place is begun, care is to be taken to have the moſt exact plan of it poſſible; and upon this, the line of circumvallation and the attack are projected. This line, being a fortification oppoſed to an enemy that may come from the open country to relieve the beſieged, ought to have its defences directed againſt them; that is, ſo as to fire from the town: and the beſiegers are to be encamped behind this line, and between it and the place. The camp ought to be as much as poſſible out of the reach of the ſhot of the place; and the line of circumvallation, which is to be farther diſtant from the place than the camp, ought much more to be out of the reach of its artillery.

As cannon are never to be fired from the rear of the camp, this line ſhould be upwards of 1200 fathoms from the place: we will ſuppoſe its diſtance fixed at 1400 fathoms from the covert way. The depth of the camp may be computed at about 30 fathom, and from the head of the camp to the line of circumvallation 120 fathoms, that the army may have room to draw up in order of battle at the head of the camp, behind the line. This diſtance, added to the 30 fathoms, makes 150 fathoms, which being added to the 1400, makes 1550 fathoms for the diſtance of the line of circumvallation from the covert-way. The top of this line is generally 12 feet broad, and 7 feet deep: the parapet runs quite round the top of it, and at certain diſtances is frequently ſtrengthened with redouts and ſmall forts; the baſe 18 feet wide, the height within 6, and on the outſide 5 feet, with a banket of 3 feet wide, and 1½ high. See CONTRAVALLATION, or COUNTERVALLATION.

CIRCUS, in *military antiquity*, a very capacious building, of a round or oval form, erected by the ancients for exhibiting ſhews to the people.

CITADEL, is a fort with 4, 5, or 6 baſtions, raiſed on the moſt advantageous ground about a city, the better to command it, and commonly divided from it by an eſplanade, the better to hinder the approach of an enemy; ſo that the citadel defends the inhabitants if they continue in their duty, and puniſhes them if they revolt. Beſiegers always attack the city firſt, that, being maſters of it, they may cover themſelves the better againſt the fire of the citadel. Its having baſtions diſtinguiſhes it from a caſtle. Sometimes the citadel ſtands half within, and half without the ramparts of the place.

CIVIC-CROWN, among the ancient Romans, was a crown given to any ſoldier who had ſaved the life of a citizen. It was compoſed only of oaken-boughs, but accounted more honourable than any other.

CLARENCIEUX, the ſecond king at arms, ſo called from the duke of Clarence, third ſon to king Edward III.

CLARIGATION, in *Roman antiquity*, a ceremony which always preceded a formal declaration of war, performed in this manner: the chief of the heralds went to the territory of the enemy; where, after ſome ſolemn prefatory indication, he, with a loud voice, intimated that he declared war againſt them for certain reaſons ſpecified, ſuch as injury done to the Roman allies, or the like.

CLAYES. See HURDLES.

CLEAR. To clear the trenches. See TRENCHES.

CLOATHING. See REGIMENTALS.

CLOY, or *to cloy guns*. See *To* NAIL.

CLOUTS. See AXLE-TREE.

CLY-MORE, a great two-handed ſword, formerly in uſe among the highlanders, two inches broad, doubly edged; the length of the blade, 3 feet 7 inches; the handle, 14 inches; of a plain tranſverſe guard, 1 foot; the weight, 6 pounds and a half. Theſe ſwords were the original weapons of England, as appears by the figure of a ſoldier found among the ruins of London, after the great fire in 1666.

COFFERS, in *fortification*, a hollow lodgment ſunk in the bottom of a dry ditch, from 6 to 7 feet deep, and from 16 to 18 feet broad, and the length of it, the whole breadth of the ſaid ditch, from ſide to ſide. The beſieged generally make uſe of theſe coffers to repulſe the beſiegers, when they attempt to paſs the ditch: they are diſtinguiſhed only by their length from *Caponiers*; and it differs from the traverſe and gallery, in that theſe are made by the beſiegers, and the coffer by the beſieged. They are covered with joiſts, hurdles, and earth, raiſed 2 feet above the bottom of the ditch; which riſing ſerves inſtead of a parapet, with loop-holes in it.

COFFRE. See CAISSON.

COHORT, in *Roman antiquity*, a name given to part of the Roman legion, comprehending about 600 men.

COINS, in *gunnery*, are a kind of wedges to lay under the breech of a gun, to raiſe or depreſs the metal.

COLONEL, in *military affairs*, the commander in chief of a regiment, whether horſe, foot, dragoons, or artillery, in England: but in France, Spain, and ſome other ſouthern nations, the colonels of horſe are called *Maîtres de Camp*; in Germany, and moſt northern nations, they are called *Ritmeeſters*. Colonels of foot take place, and command one another, according to the ſeniority of their regiments, and not of their commiſſions; but thoſe of horſe, on the contrary, according to the dates of their commiſſions.

COLONEL *of horſe*, who is the firſt officer of the regiment; hence his attention ought to be given to keeping the regiment complete, to have it compoſed of both men and horſes fit for the ſervice, and to take particular care to have them well exerciſed and taught the different evolutions; to be able on all occaſions to form themſelves according to the ground, or manner in which they may attack or be attacked.

COLONEL *of foot*, or *infantry*. His functions are more extenſive than thoſe of the cavalry, as the infantry are employed to more different purpoſes. They ſhould underſtand ſomething of fortification, and be well acquainted with field-engineering. He cannot be too careful to maintain union and harmony among his officers; and, to ſucceed in this, he muſt acquire their eſteem and confidence, and make himſelf to be reſpected. The true way to ſucceed in this, is to keep up ſubordination with unalterable firmneſs; to do juſtice to every one, to employ all his credit to procure favours to the corps in general, and to the officers in particular.

COLONEL *of dragoons* is nearly connected with that of horſe, to which word I refer the reader.

COLONEL *of artillery*. The commander of a battalion of artillery is one of the moſt laborious employments both in war and peace, requiring the greateſt ability, application, and experience. He is ſuppoſed to be a very able mathematician and engineer, to be thoroughly acquainted with the power of artillery, to underſtand the attack and defence of fortifications in all the different branches; to be able on all occaſions to form the artillery according to the ground or manner in which they may attack or be attacked; in ſhort, he ſhould be maſter of every thing belonging to that important corps.

COLONEL *of engineers*, ſhould be a very able mathematician and mechanic, maſter of fortification, in planning, conſtructing, attacking, and defending the ſame. See ENGINEER.

Lieutenant COLONEL, is the ſecond perſon in command of a regiment, and it is under his direction that the affairs of the regiment chiefly roll. He is to have great qualifications, anſwerable to the corps he has the honour to ſerve in.

COLOURS, in the *military art*, are large ſilk flags fixed on half pikes, and carried by the enſign: when a battalion is encamped, they are placed in its front; but in garriſon they are lodged with the commanding officer.

The firſt ſtandard, guidon, or colours of a regiment, is not to be carried on any guard but that of his Majeſty, the Queen, Prince of Wales, or captain-general.

The ſize of the colours to be 6 feet 6 inches flying, and 6 feet deep on the pike. The length of the pike (ſpear and ferril included) to be 9 feet 10 inches. The cords and taſſels of the whole to be crimſon and gold mixed.

Camp-COLOURS, are a ſmall ſort placed on the right and left of the parade of a regiment when in the field: they are 18 inches ſquare, and of the colour of the facing of the regiment, with the number of the regiment upon them. The poles to be 7 feet 6 inches long, except thoſe of the quarter and rear-guards, which are to be 9 feet.

COLOUR-*guard*. See GUARD.

COLUMN, in the *art of war*, a long, deep file of troops or baggage. The advantages and diſadvantages of columns are ſo numerous, that I will only mention, that the column ought to be able to form near the enemy, and in ſuch a poſition, as not to ſuffer much from the artillery; that their motions be ſwift, ſo as not to ſuffer much during the operation; and that the diviſions, in ſhort, which compoſe it, be ſo arranged as to afford each other a mutual defence and aſſiſtance, in caſe they ſhould be attacked. Such are the principles that ſhould guide, in forming of columns judiciouſly, and of freeing them from that multiplicity of inconveniences which make them liable to the moſt melancholy accidents.

COMMAND, in *military affairs*, generally called *the word of command*, are terms uſed by officers in exerciſe, or upon ſervice.

COMMANDANT, is that perſon who has the command of a garriſon, fort, caſtle, regiment, company, &c.

COMMANDING-*ground*, implies, in a *military ſenſe*, a riſing ground which overlooks every poſt, or ſtrong place. There are, ſtrictly ſpeaking, three ſorts of commanding grounds; namely,

Front COMMANDING-*ground*. Every height is called ſo, that lies oppoſite to the face of the poſt which plays upon its front.

Reverſe COMMANDING-*ground*, an eminence which plays upon the rear of a poſt.

Enfilade COMMANDING-*ground*, or *Curtain* COMMANDING-*ground*, a high place, which, with its ſhot, ſcours all the length of a line, &c.

COMMANDERY, a certain benefice belonging to ſome military order.

COMMISSARY, in *military affairs*, is of various denominations, though generally a civil officer appointed to inſpect the muſters, ſtores and proviſions for the army. In war-time their number is unlimited, but generally very numerous.

Commissary-*general of the muſters*, or *muſter-maſter general*. He takes account of the ſtrength of every regiment as often as he pleaſes; reviews them, ſees the horſe be well mounted, and all the men well armed and clothed. He receives and inſpects the muſter-rolls, and knows exactly the ſtrength of the army.

Commissary-*general of ſtores*, a civil officer in the artillery, who has the charge of all the ſtores, for which he is accountable to the office of ordnance. He is allowed various other commiſſaries, clerks, and conductors, eſpecially in war-time.

Commissary *of the train-horſes*, a civil officer likewiſe of the artillery, who has the inſpection of all horſes belonging to the train, the hoſpital, and the bakery; having under him a number of conductors, drivers, &c.

Commissary-*general of proviſions*, has the charge of furniſhing the army in the field with all ſorts of proviſions, forage, &c. by contract: he muſt be very vigilant and induſtrious, that they may never ſuffer want. He has under him various commiſſaries, ſtore-keepers, clerks, &c.

COMMISSION, in a *military ſenſe*, is the authority by which every officer acts in his poſt. All commiſſions are ſigned by the king, or by his general, if he be impowered.

Commission *officers*. See Officers.

COMMITTEE, a ſelect number of perſons to whom the more particular conſideration of ſome matter is referred, and who are to report their opinion to the court, &c. of which they are members.

COMMUNICATION. See *Line of Communication.*

COMPANY, in a *military ſenſe*, means a ſmall body of foot or artillery, the number of which is never fixed, but generally from 45 to 110, commanded by a captain, a lieutenant, and an enſign, and ſometimes by a firſt and ſecond lieutenant, as in the artillery. A company has uſually 2 ſerjeants, 3 or 4 corporals, and 2 drums. In the guards the companies conſiſt of 80 men each.

Free Company, is one of thoſe corps commonly called irregular; is ſeldom or never under the ſame orders with the regular corps of the army, but for the moſt part acts like a detached army, either by itſelf, or in conjunction with ſome of its own kind; therefore their operations are properly conſidered under the title of the *petite guerre*.

Independent Company, that which is not incorporated in a regiment. Two ſuch companies generally belong to each regiment in England, who are to ſupply the regiments with recruits.

COMPLEMENT *of the curtain*, in *fortification*, is that part of the curtain which, being wanting, is the demi-gorge. See Fortification.

Complement *of the line of defence*, the remainder of the line of defence, after you have taken away the angle of the flank. See Fortification.

Complement *of the line of the army*. See Honours.

Complement *from guards*. See Honours.

COMPOUND *motion*. See Gunnery.

COMPTROLLER *of the artillery*, inſpects the muſters of the artillery, makes the pay-liſt, takes the account and remains of ſtores, and is accountable to the office of ordnance. This poſt is only in war-time.

CONGRESS, in *military and political affairs*, is an aſſembly of commiſſioners, deputies, envoys, &c. from ſeveral courts, meeting to agree on peace, or to concert matters for their common good.

CONDUCTORS, are aſſiſtants to the commiſſary of ſtores, to conduct depots, or magazines, from one place to another: they have alſo the care of the ammunition waggons in the field: they report to the commiſſary, and are under his command.

CONTACT, a touching, or the point or points where one body touches another.

CONTINGENT, ſomething caſual or uncertain, that may or may not happen.

CONTRAMURE, in *fortification*, is a wall built before another partition-wall to ſtrengthen it, ſo that it may receive no damage from the adjacent buildings.

CONTRAVALLATION, in the *art military*, implies a line formed in the ſame manner as the line of circumvallation, to defend the beſiegers againſt the enterpriſes of the garriſon: ſo that the army, forming a ſiege, lies between the lines of circumvallation and contravallation. The trench of this line is towards the town, at the foot of the parapet, and is never made but when the garriſon is numerous enough to harraſs and interrupt the beſiegers by ſallies. This line is conſtructed in the rear of the camp, and by the ſame rule as the line of circumvallation, with this difference, that as it is only intended to reſiſt a body of troops much inferior to a ſorce which might attack the circumvallation, ſo its parapet is not made ſo thick, nor the ditch ſo wide and deep; 6 feet is ſufficient for the 1ſt, and the ditch 8 feet broad, and 5 feet deep.

Amongſt the ancients this line was very common, but their garriſons were much ſtronger than ours; for, as the inhabitants of towns were then almoſt the only ſoldiers, there were commonly as many troops to defend a place, as there were inhabitants in it. The lines of circumvallation and contravallation are very ancient, examples of them being found in hiſtories of the remoteſt antiquity. The author of the military hiſtory of *Louis le Grand* pretends, however, that *Cæſar* was the firſt inventor of them; but it appears from the chevalier de Follard's treatiſe on the method of attack and defence of places, uſed by the ancients, how little foundation there is for this opinion. This author aſſerts, with great probability on his ſide, that theſe lines are as ancient as the time in which towns were firſt ſurrounded with walls, or, in other words, fortified.

CONTRE *Queuë d'yronde*
Queuë d'yronde } See *Swallow's Tail.*

CONTRIBUTION, in *military hiſtory*, is an impoſition or tax paid by countries who ſuffer the fury of war, to redeem themſelves from being plundered and totally deſtroyed by the enemy; or when a belligerent prince wants money, raiſes it by contribution on the enemy's country, and is either paid in proviſion or in money, and ſometimes in both.

CONVERSION, is a military motion or manœuvre, which turns the front of a battalion where the flank was, when the flank is attacked.

CONVOY, in *military affairs*, a detachment of troops employed to guard any ſupply of men, money, ammunition, proviſions, ſtores, &c. conveyed in time of war, by land or ſea, to a town, army, or the like. A body of men that marches to ſecure any thing from falling into the enemy's hand, is alſo called a *Convoy*. An officer, having the command of a convoy, muſt take all poſſible precautions for its ſecurity; and endeavour, before its march, to procure ſome good intelligence concerning the enemy's out-parties: and as the commanding-officer of the place from which the convoy is to march, and thoſe of ſuch other places as he is to paſs by, are the moſt proper perſons to apply to for aſſiſtance; he muſt therefore take ſuch meaſures as will enable him to keep up a conſtant intercourſe with them. The conducting a convoy is one of the moſt important and moſt difficult of all military operations.

COPPER-*boats*. See Pontoons.

CORBEILLES. See Baskets.

CORDEAU, a line uſed by engineers, divided into fathoms, and feet, &c. to mark out works on the ground.

CORDON, in *fortification*, is a row of ſtones made round on the outſide, and placed between the termination of the ſlope of the wall, and the parapet which ſtands perpendicular, in ſuch a manner, that this difference may not be offenſive to the eye; whence thoſe cordons ſerve only as ornaments in walled fortifications.

Cordon, in *military hiſtory*, is an imaginary line of ſeparation between two armies, either in the field or in winter-quarters.

CORIDOR. See Covert-way.

CORNET, in the *military hiſtory of the ancients*, an inſtrument much in the nature of a trumpet: when the cornet only ſounded, the enſigns were to march alone without the ſoldiers; whereas, when the trumpet only ſounded, the ſoldiers were to move forward without the enſigns.

Cornet, in the *military hiſtory of the moderns*, the third commiſſion officer in a troop of horſe or dragoons, ſubordinate to the captain and lieutenant, equivalent to the enſign amongſt the foot. His duty is to carry the ſtandard, near the centre of the front rank of the ſquadron.

CORNISH-*ring*, in *gunnery*, the next ring from the muzzle backwards. See Cannon.

CORPORAL, an inferior or non-commiſſion officer of foot, under a ſerjeant, who has charge of one of the ſquads of a company, places and relieves centinels, and keeps good order in the guard. He receives the word of the inferior rounds that paſs by his guard. Every company has 3 or 4 corporals.

Lance-Corporal, one who acts as corporal.

CORPS *de Garde*. See Guard.

Corps *de Battaille*. The main body of an army drawn up for battle, whereof the firſt line is called the van, the ſecond the main body, and the third the body of reſerve, or rear-guard. See Battle.

Corps *de Reſerve*. See Rear-Guard.

CORSAIR, in *naval hiſtory*, a name given to the piratical cruiſers of Barbary, who frequently plunder the merchant-ſhips of countries with whom they are at peace.

CORSELET, a little cuiraſs; or, according to others, an armour, or coat made to cover the whole body anciently worn by the pikemen, uſually placed in the fronts and flanks of the battle, for the better reſiſting the enemy's aſſaults, and guarding the ſoldiers placed behind them.

COSSACKS, in *military hiſtory*, a wild irregular people, who inhabit the Ukraine, and live by plunder and piracy, in ſmall veſſels on the Black Sea. A ſcythe fixed on the end of a pole was their ancient weapon. They are now a regular militia, and uſe the ſame arms as the Croats and Pandours.

COUNCIL *of war*, in *military affairs*, is an aſſembly of principal officers of an army or fleet, called by the general or admiral who commands, to concert meaſures for their conduct.

COUNTER-*forts*, in *fortification*, are certain pillars and parts of the wall, diſtant from 15 to 20 feet one from another, which advance themſelves as much as may be in the ground, join themſelves to the height of the cordon by vaults, to ſuſtain the chemin de rondes, and the part of the rampart, to fortify the wall, and ſtrengthen the ground.

COUNTERVALLATION, or *line of countervallation*, a trench with a parapet, made by the beſiegers, betwixt them and the place beſieged, to ſecure them from the ſallies of the garriſon; ſo that the troops which form the ſiege, are encamped between the lines of circumvallation and countervallation. When the enemy has no army in the field, theſe lines are uſeleſs.

COUNTERMARCH, in a *military ſenſe*, is to march back again; a change of the wings and front of an army, battalion, or company, whereby the men in the front come to be in the rear.

COUP-*d'œil*, in *military hiſtory*, implies, in battle, to throw an attacking army into diſorder, or, by its ſucceſſion of reſource, drive away an oppoſition not formed adequate to repulſe its attackers. *Coup-d'œil*, in *field fortification*, is, by irregular and detached works adapted to the ground, to form a complete ſyſtematical piece of fortification, though to a common eye disjointed and unconnected. So that this French word may not be improperly called a ſtratagem of war.

COURIER, in a *military ſenſe*, means a meſſenger ſent poſt, or expreſs, to carry diſpatches of battles gained, loſt, &c. or any other occurrences that happen in war.

COURT-*martial*, a court appointed for the puniſhment of offences in officers, under-officers, ſoldiers, and ſailors; the powers of which are regulated by the mutiny-bill, in the words, and to the effect following. His majeſty may, from time to time, grant a commiſſion, under his royal ſign manual, to any officer, not under the degree of a field-officer, for the holding a general court-martial within this realm; and alſo grant his warrant to the lord lieutenant of Ireland, or other chief governor or governors there for the time being, or the governor or governors of Minorca, Gibraltar, and any of his majeſty's dominions beyond the ſeas reſpectively, or the perſon or perſons there commanding in chief, from time to time, to appoint courts-martial in the kingdom of Ireland, and other places and dominions reſpectively; in which courts-martial, all offences mentioned in the articles of war, and all other offences hereinafter ſpecified, ſhall be tried and proceeded againſt in ſuch manner as the act for that purpoſe directs. The courts have power by their ſentence of judgment to inflict corporal puniſhment, not extending to life or limb, on any ſoldier, for immoralities, miſbehaviour, or neglect of duty. A general court-martial ſhall not conſiſt of a leſs number than 13, whereof none to be under the degree of a commiſſion officer; and the preſident of ſuch general court-martial ſhall neither be the commander in chief, or governor of the garriſon where the offender ſhall be tried, nor under the degree of a field-officer, unleſs where a field-officer cannot be had; in which caſe the officer next in ſeniority, not being under the degree of a captain, ſhall preſide at ſuch court-martial; and that ſuch court-martial ſhall have power and authority to adminiſter an oath to every witneſs, in order to the examination or trial of any of the offences that ſhall come before them.

That in all trials of offenders by general courts-martial, to be held by virtue of this act, every officer preſent at ſuch trial, before any proceedings be had thereupon, ſhall take the following oaths upon the holy evangeliſts, before the court and judge advocate, or his deputy (who are hereby authorized to adminiſter the ſame) in theſe words,

“You ſhall well and truly try and determine according to your evidence, in the matter now before you, between our ſovereign lord the king's majeſty, and the priſoner to be tried:
“So help you God.”

The oath, “I *A. B.* do ſwear, that I will duly adminiſter juſtice according to the rules and articles for the better government of his majeſty's forces, and according to an act of parliament now in force for the puniſhment of mutiny and deſertion, and other crimes therein mentioned, without partiality, favour, or affection; and if any doubt ſhall ariſe, which is not explained by the ſaid articles or act of parliament, according to my conſcience, the beſt of my underſtanding, and the cuſtom of war in the like caſes. And I further ſwear, that I will not divulge the ſentence of the court until it ſhall be approved by his majeſty, the general, or commander in chief; neither will I upon any account, at any time whatſoever, diſcloſe or diſcover the vote or opinion of any particular member of the court-martial, unleſs required to give evidence thereof, as a witneſs, by a court of juſtice in a due courſe of law.

"So help me God."

And as ſoon as the ſaid oaths ſhall have been adminiſtered to the reſpective members, the preſident of the court is hereby authoriſed and required to adminiſter to the judge advocate, or the perſon officiating as ſuch, an oath in the following words:

The oath. "I *A. B.* do ſwear, that I will not, upon any account, at any time whatſoever, diſcloſe or diſcover the vote or opinion of any particular member of the court-martial, unleſs required to give evidence thereof as a witneſs by a court of juſtice in a due courſe of law.

"So help me God."

And no ſentence of death ſhall be given againſt any offender in ſuch caſe by any general court-martial, unleſs 9 officers preſent ſhall concur therein; and if there be more officers preſent than 13, then the judgment ſhall paſs by the concurrence of two-thirds of the officers preſent; and no proceeding or trial ſhall be had upon any offence, but between the hours of 8 o'clock in the morning and 3 in the afternoon, except in caſes which require an immediate example.

Provided always, that the party tried by any general court-martial in the kingdom of Great-Britain or Ireland, or in Jerſey, Guernſey, Alderney, or Sark, or the iſlands thereto belonging, ſhall be intitled to a copy of the ſentence and proceedings of ſuch court-martial, upon demand thereof made by himſelf, or by any other perſon or perſons on his behalf (he or they paying reaſonably for the ſame) at any time not ſooner than 3 months after ſuch ſentence: and in caſe of trials by any general court-martial at Gibraltar or Minorca, at any time not ſooner than 6 months after the ſentence given by ſuch court-martial; and in caſe of trials by any general court-martial in his majeſty's other dominions beyond the ſeas, at any time not ſooner than 12 months after the ſentence given by ſuch court-martial, whether ſuch ſentences be approved or not; any thing in this act notwithſtanding.

Provided alſo, and be it enacted by the authority aforeſaid, that every judge advocate, or perſon officiating as ſuch, at any general court-martial, do, and he is hereby required to tranſmit, with as much expedition, as the opportunity of time and diſtance of place can admit, the original proceedings and ſentence of ſuch court-martial to the judge advocate general in London; which ſaid original proceedings and ſentence ſhall be carefully kept and preſerved in the office of ſuch judge advocate general, to the end that the perſons intitled thereto may be enabled, upon application to the ſaid office, to obtain copies thereof, according to the true intent and meaning of this act.

Provided always, and be it hereby declared and enacted, that no officer or ſoldier, being acquitted or convicted of any offence, be liable to be tried a ſecond time, by the ſame or any other court-martial, for the ſame offence, unleſs in caſe of an appeal from a regimental to a general court-martial; and that no ſentence given by any court-martial, and ſigned by the preſident thereof, be liable to be reviſed more than once.

COUP-DE-MAIN, in *military affairs*, implies a deſperate reſolution in all ſmall expeditions, of ſurpriſe, &c. The favourable ſide of the propoſed action muſt ever be viewed; for if what may happen, arrive, or fall out, is chiefly thought upon, it will, at the very beſt, greatly diſcourage, but, in general, it will end in a total failure. The very name of an expedition implies riſk, hazard, precarious warfare, and a critical but deſperate operation, or *Coup-de-main.*

COVERT-WAY, in *fortification*, is a ſpace of 5 or 6 fathoms on the border of the ditch towards the country, covered by a riſing ground, which has a gentle ſlope towards the field. This ſlope is called the glacis of the covert-way. See FORTIFICATION.

Second COVERT-WAY, or, as the French call it *avant-chemin couvert*, is the covert-way at the foot of the glacis. See FORTIFICATION.

COVER, in a *military ſenſe*, means that the files cover one another exactly. Troops are ſaid to be covered when poſted out of the danger of the enemy's fire.

COUNTER-*approaches*. See APPROACHES.

COUNTER-*battery*. See BATTERY.

COUNTER-*breaſtwork*. See FALSE-BRAY.

COUNTER-*forts*, in *fortification*, are certain pillars, and parts of the wall of a fortification, at about 15 or 20 feet diſtance from each other, which are advanced as much as poſſible in the ground, and joined to the height of the cordon by vaults, to ſupport the way of the rounds, and part of the ramparts; as alſo to fortify the wall, and ſtrengthen the ground; generally uſed in large and ſtrong fortifications.

COUNTER-*guards*, in *fortification*, are ſmall ramparts, with parapets and ditches, to cover ſome part of the body of the place. They are of ſeveral ſhapes, and differently ſituated. They are generally made before the baſtions, in order to cover the oppoſite flanks from being ſeen from the covert-way; conſiſting then of 2 faces, making a ſalient angle, and parallel to the faces of the baſtion. They are ſometimes made before the ravelins. See FORTIFICATION.

COUNTER-*round*. See ROUNDS.

COUNTER-*mine*. See MINES.

COUNTERSCARP, in *fortification*, is properly the exterior talus, or ſlope of the ditch, on the farther ſide from the place, and facing it. Sometimes the covert-way and glacis are meant by this expreſſion. See FORTIFICATION.

COUNTER-*ſwallow's-tail*, in *fortification*, is a kind of an out-work very much reſembling a ſingle tenaille.

COUNTER-*march*. See MARCH.

To COUNTERMAND, is to give contrary orders to thoſe already given, to contradict former orders, &c.

COUPURE, in *fortification*, are paſſages, ſometimes cut through the glacis, of about 12 or 15 feet broad, in the re-entering angle of the covert-way, to facilitate the ſallies of the beſieged. They are ſometimes made through the lower curtain, to let boats into a little haven built on the rentrant angle of the counterſcarp of the out-works.

COURONEMENT, or *Couronnement*, in *fortification*, implies the moſt exterior part of a work when beſieged.

CRAB. See GIN.

CRANE, an inſtrument made with ropes, pullies, and hooks, by which great weights are raiſed.

CREMAILLE, in *field fortification*, is when the inſide line of the parapet is broken in ſuch a manner as to reſemble the teeth of a ſaw; whereby this advantage is gained, that a greater fire can be brought to bear upon the defile, than if only a ſimple face was oppoſed to it; and conſequently the paſſage is rendered more difficult.

Redouts en CREMAILLERE, or *Cremaille*, are ſuch as are conſtructed as above mentioned.

CRETE, in *fortification*, implies the earth thrown out of the ditch in a fortification, trench, &c.

CROATS, in *military hiſtory*, light irregular troops ſo called; generally people of Croatia. They are commanded upon all deſperate ſervices, whoſe method of fighting is the ſame as the Pandours. They wear a ſhort waiſtcoat, and long wide breeches, with light boots, and a cap greatly reſembling the huſſar cap. Their arms are a long firelock with rifled barrel, and ſhort bayonet, a crooked hanger, and brace of piſtols. The empreſs queen has 5000 of theſe troops, the greateſt part of which have no pay, but live by plunder, at which they are remarkably dexterous.

CROWN-*work*, in *fortification*, an out-work that takes up more ground than any other. It conſiſts of a large gorge, and two ſides terminating towards the country in two demi-baſtions, each of which is joined by a particular curtain, forming two half baſtions and one whole one: they are made before the curtain, or the baſtion, and generally ſerve to incloſe ſome buildings which cannot be brought within the body of the place, or to cover the town gates, or elſe to occupy a ſpot of ground which might be advantageous to the enemy. See FORTIFICATION.

CROWNED *horn-work*, in *fortification*, is a horn-work, with a crown-work before it.

CROSS-*fire*, in *the art of war*, is when the fire of two or more adjoining ſides of a field-redout, &c. croſſes each other; frequently uſed in preventing an enemy's paſſing a defile. It may be two ways obtained: firſt, by conſtructing the redout with the face oppoſite to the defile, tenailled; that is, forming a re-entering angle. The other way is, to defend the defile by 2 redouts, whoſe faces command the paſſage, flanking each other at the ſame time.

CROSS-*bars*. See CARRIAGES.

CROWS-*feet*, in the *art of war*, are 4 pointed irons, ſo made, that what way ſoever they fall, one point is always uppermoſt. They are about 4 inches long, the ſhort ones, and the long ones 6 or 7. The ſhort ones are thrown on bridges, &c. and the long ones on the earth, both to incommode the cavalry, that they may not approach without great difficulty.

CROISADE }
CRUSADE } in *military hiſtory*, implies a holy war, or an expedition of the Chriſtians againſt the Infidels for the recovery of the holy-land, and ſo called from thoſe who engaged in it wearing a croſs on their clothes.

CUBE, a ſolid, conſiſting of 6 equal ſquare ſides. The ſolidity of any cube is found by multiplying the ſuperficial content of any one of the ſides by the height. Cubes are to one another in the triplicate ratio of their diagonals.

CUBE-*root*, is the ſide of one of the ſquares conſtituting the cube. Thus, if the ſolidity of a cube be 64, the ſide of one of the ſquares, or cube-root, will be 4: becauſe $4 \times 4 = 16$, the ſuperficial content of the ſquare, and $16 \times 4 = 64$, the ſolidity of the cube.

CUBIC *equation, in algebra*, is an equation whoſe higheſt power conſiſts of three dimenſions, as $x = a^3 - 6^3$. See EQUATION.

CUBIC *foot*, implies ſo much as is contained in a cube whoſe ſide is 1 foot, or 12 inches.

CUBIC *hyperbola*, is a figure expreſſed by the equation $xy^2 = a$, having 2 aſymptotes, and conſiſting of 2 hyperbolas, lying in the adjoining angles of the aſymptotes, and not in the oppoſite angles, like the Apollonian hyperbola, being otherwiſe called, by Sir Iſaac Newton, in his *enumeratio linearum tertii ordinis*, an hyperboliſmus of a parabola; and is the 65th ſpecies of lines, according to him.

CUBIC *number*, is that which is produced by multiplying any number by itſelf, and then again the product by that number; as 27 is a cube number, ſince $3 \times 3 = 9 \times 3 = 27$. The difference of two cubic numbers, whoſe roots differ by unity, is equal to the aggregate of the ſquare of the root of the greater, double the ſquare of the leſs, and the leſs root.

CUBIC *parabola*, a curve of the ſecond order, having infinite legs, tending contrary ways.

CUIRASSIERS, in the *military art*, are a ſort of heavy cavalry armed with cuiraſſes, as moſt of the German horſe are. The ſeveral German powers have regiments of cuiraſſiers, eſpecially the emperor, and the king of Pruſſia. The king of France has alſo one regiment: but we have had none in the Engliſh army ſince the Revolution.

CUIRASSE, a piece of defenſive armour, made of plate, well hammered, ſerving to cover the body, from the neck to the girdle, both before and behind, called breaſt and back-plate.

CULVERIN,
CULVERIN-*ordinary*, } See CANNON.
CULVERIN *of the largeſt ſize*,

CUNEUS. See WEDGE.

CUNETTE. See CUVETTE.

CURFEW-*bell*, in *military hiſtory*, a ſignal given in cities taken in war, &c. to the inhabitants to go to bed. The moſt eminent curfew in England, was that eſtabliſhed by William the Conqueror, who appointed, under ſevere penalties, that, at the ringing of a bell, at 8 o'clock in the evening, every one ſhould put out their lights and fires, and go to bed, &c.

CURTAIN, in *fortification*, is that part of the body of the place, which joins the flank of one baſtion to that of the next. See FORTIFICATION.

Angle of the CURTAIN, } See FORTIFICATION.
Complement of the CURTAIN,

CUTLER, a *military artificer*, whoſe buſineſs is to forge, temper, and mount all ſorts of ſword-blades.

CYCLOPŒDIA. See ENCYCLOPOEDIA.

CYCLOID, in *geometry*, a curve generated in the following manner.

If a circle ABC (Pl. XII. fig. 6) reſting on a right line AL, begin to revolve in the manner of a wheel, from A towards L, the point A will, by its two-fold motion, deſcribe the curve $ACDJL$, while the circle makes one revolution from A to L.

This curve is called the cycloid; and from its formation it is evident, (1.) That the baſe of the cycloid AL is equal to the periphery of the generating circle ABC. (2.) That the axis of the cycloid FD is equal to the diameter of the ſaid circle. (3.) That the part of the baſe KL is equal to the arch of the circle IK; (4.) therefore KF ($= ME = IG$) is equal to the remaining arch IH, or GD. (5.) That the chord of the circle KI is perpendicular to the cycloid in the point I; and (6.) therefore the chord HI (being at right-angles with IK) is a tangent to the curve in the point I. (7.) The ſaid tangent HI is parallel to the chord DG.

Parallel to EI draw ei indefinitely near; and In perpendicular thereto; then will the triangles DGE, DGF, Ini, be ſimilar; and ſo we have $DE : DG :: DG : DF :: In : Ii$; conſequently, the ſemi-cycloid $DIL = 2\,DF$, the diameter of the generating circle. Pl. XII. fig. 6.

CUVETTE, in *fortification*, is a ſmall ditch of 10 or 12 feet broad, made in the middle of a large dry ditch, about 4 or 4½ feet deep, ſerving as a retrenchment to defend the ditch, or elſe to let water in, if it can be had in the time of a ſiege. See FORTIFICATION.

CYLINDER, or *concave cylinder of a gun*, is all the hollow length of the piece, or bore. See CANNON.

Charged CYLINDER, the chamber, or that part which receives the powder and ball. See CANNON.

Vacant CYLINDER, that part of the hollow or bore which remains empty when the piece is loaded.

CYMBAL, in *ancient military hiſtory*, a warlike muſical inſtrument in uſe among the ancients, made of braſs, not unlike our kettle-drums, and, as ſome think, in their form, but ſmaller.

CZAR, in *military hiſtory*, a title of honour aſſumed by the great dukes, or, as they are now ſtiled, emperors of Ruſſia. This title is no doubt, by corruption, taken from *Cæſar*, emperor; and accordingly they bear an eagle, as the ſymbol of their empire. The firſt that bore this title was Baſil, the ſon of Baſilides, about the year 1470.

D

DAGGER, in *military affairs*, a ſhort ſword, or poignard, about 12 or 13 inches long, with a baſket-hilt. It is not long ſince, that ducliſts fought with ſword and dagger.

DAM. See DYKE.

DART, in *ancient military hiſtory*, implies a ſmall kind of lance, thrown by the hand.

DAUPHIN, a title given to the eldeſt ſon of France, and heir preſumptive to the crown, on account of the province of Dauphiny, which, in 1343, was given to Philip of Velois, on this condition, by Humbert, dauphin of the Viennois.

DEBENTURE, is a kind of warrant, given in the office of the board of ordnance, whereby the perſon whoſe name is therein ſpecified, is intitled to receive ſuch a ſum of money as by former contract had been agreed on, whether wages, or otherwiſe. Debenture, in ſome of the acts of parliament, denotes a kind of bond or bill, firſt given in 1649, whereby the government is charged to pay the ſoldier, creditor, or his aſſigns, the money due on auditing the account of his arrears.

DECAGON, in *fortification*, is a polygon figure, having 10 ſides, and as many angles; and if all the ſides are equal, and all the angles, it is called a regular decagon, and may be inſcribed in a circle. The ſides of a regular decagon are, in power and length, equal to the greateſt ſegment of an hexagon inſcribed in the ſame circle, and cut in extreme and mean proportion. If A B (Plate xii. *fig.* 7.) be the ſide of a regular decagon inſcribed in a circle, and it be continued out to C, ſo that B C=A D, then will A B:B C::B C:A C. Thence let r be the radius of the circle, and put AB=x, then became AB×AC=BC^2, we have $x\times\overline{r\times x}=rr$; hence by completing the ſquare, &c. we get $x=\sqrt{\frac{5}{2}-\frac{1}{2}}=r$, the ſide of the decagon inſcribed in that circle.

DECAMPING, or *to decamp*, in *military affairs*, is the marching of an army or body of men from the ground where it before lay encamped. See CAMP.

DECANUS, in *Roman military hiſtory*, an officer who preſided over ten other officers, and was head of the contubernium, or ſerjeant of a file of Roman ſoldiers.

DECIMATION, in *Roman military hiſtory*, a puniſhment inflicted upon ſuch ſoldiers as quitted their poſt, or behaved themſelves cowardly in the field. The names of all the guilty were put into an urn or helmet, and as many were drawn out as made the tenth part of the whole number; and theſe were put to the ſword, and the others ſaved.

DECURIO, in *Roman military hiſtory*, a commander of ten men in the army, or chief of a decury.

DECURY, ten Roman ſoldiers ranged under one chief, or leader, called the Decurio.

DEFENCE, in *fortification*, are all ſorts of works that cover and defend the oppoſite poſts; as flanks, parapets, cazemettes, and fauſſe-brays. It is almoſt impoſſible to fix the miner to the face of a baſtion, till the defences of the oppoſite one are ruined, that is, till the parapet of its flank is beaten down, and the cannon, in all parts that can fire upon that face which is attacked, are diſmounted. See FORTIFICATION.

Line of DEFENCE, repreſents the flight of a muſket-ball from the place where the muſketeers ſtand, to ſcour the face of the baſtion, and ſhould never exceed the reach of a muſket. It is either fichant or razant: the firſt is when it is drawn from the angle of the curtain to the flanked angle; the laſt, when it is drawn from a point in the curtain, razing the face of the baſtion.

Line of DEFENCE is the diſtance between the ſalient angle of the baſtion, and the oppoſite flank; that is, it is the face produced to the flank. See FORTIFICATION.

DEFENCE *of rivers*, in *military affairs*, is a vigorous effort to prevent the enemy from paſſing; to prevent which, a careful and attentive officer will raiſe redouts, and if neceſſary join curtains thereto: he will place them as near the banks as poſſible, obſerving to cut a trench through the ground at the windings of the river, which may be favourable to the enemy, and place advanced redouts there, to prevent his having any ground fit to form on, &c. See RIVERS.

To be in a poſture of DEFENCE, is to be provided to oppoſe an enemy, whether in regard to redouts, batteries, or in the open field.

DEFENSIVE-*War*. See WAR.

DEFILE, in *military affairs*, a ſtrait narrow paſſage, or road, through which the troops cannot march, otherwiſe than in making a ſmall front, and filing off; ſo that the enemy may take an opportunity to ſtop or harraſs their march, and to charge them with ſo much the more advantage, becauſe the rear cannot come up to the relief of the front.

To DEFILE, is to reduce diviſions or platoons into a ſmall front, in order to march through a defile; which is moſt conveniently done by facing to either the right or left, and then wheeling to either right or left, and marching through by files, &c.

DEFILING *a lodgment*. See ENFILADE.

DEGRADATION, in a *military life*, the act of depriving an officer for ever of his commiſſion, rank, dignity, or degree of honour; and taking away, at the ſame time, title, badge, and every other privilege of an officer.

DEGREE. Though this term properly belongs to geometry, nevertheleſs it is very frequently uſed both in fortification, and gunnery. Hence it will not be improper to declare, that it is a diviſion of a circle, including a 360th part of its circumference. Every circle is ſuppoſed to be divided into 360°, parts called degrees, and each degree into 60′, other parts, called minutes; each of theſe minutes being divided into 60″, each ſecond into thirds, and ſo on.

DEHORS, in the *military art*, are all ſorts of out-works in general, placed at ſome diſtance from the walls of a fortification, the better to ſecure the main places, and to protect the ſiege, &c. See FORTIFICATION.

DELINEATION. See DESIGNING.

DEMI-BASTION, is a work with only one face and one flank. See FORTIFICATION.

DEMI
CANNON, *loweſt*,
CANNON, *ordinary*,
CULVERIN,
CULVERIN *of the* *largeſt ſort*, *leaſt ſize*, *eldeſt ſort*.
See CANNON.

DEMI-LINE, in *fortification*, is a work placed before the curtain to cover it, and prevent the flanks from being diſcovered ſideways: it is made of two faces, meeting in an outward angle. See FORTIFICATION.

DEMI-GORGE, in *fortification*, is half the gorge, or entrance into the baſtion, not taken directly from angle to angle, where the baſtion joins to the curtain, but from the angle of the flank to the centre of the baſtion; or the angle the two curtains would make, by their prolongation. See FORTIFICATION.

DENSITY *of bodies*. See MOTION.

DEPOT, in the *military phraſe*, ſignifies a particular place at the tail of the trenches, out of the reach of the cannon of the place, where the troops generally aſſemble, who are ordered either to attack the out-works, or ſupport the troops in the trenches, when there is reaſon to imagine the beſieged intend making a vigorous ſally.

DEPOT, likewiſe means a temporary magazine for forage, for faſcines, gabions, tools, and every other thing neceſſary for the ſupport of an army, or for carrying on a ſiege.

DEPTH *of a battalion or ſquadron*, in *military affairs*, the number of ranks, or the quantity of men. Infantry were formerly drawn up 6 or 8 deep, that is, conſiſting of ſo many ranks; but now they are generally drawn up only 3 deep, and in the defence of a breaſt-work but 2 deep. When infantry is drawn up 3 deep, the firſt rank is called the front-rank; the ſecond, the centre rank; and the third, the rear rank: and the files which bind the right and left, are called the flanks. The cavalry is generally drawn up 3 deep, and on ſome occaſions only 2 deep.

DESCENT. See MOTION.

DESCENTS, in *fortification*, are the holes, vaults, and hollow places, made by undermining the ground.

DESCENT *into the ditch*, is a paſſage made through the eſplanade and covert-way, in form of a trench, the upper part of which is covered with madriers, and clays or hurdles, to ſecure the beſiegers from the enemy's fire. In wet ditches this trench is on a level with the ſurface of the water, but in dry ones it is ſunk as deep as the bottom of the ditch.

DESERTER, in a *military ſenſe*, a ſoldier who, by running away from his regiment and company, abandons the ſervice.

Penalty of DESERTION. All officers and ſoldiers, who having received pay, or having been duly inliſted in our ſervice, ſhall be convicted of having deſerted the ſame, ſhall ſuffer death, or ſuch other puniſhment as by a court-martial ſhall be inflicted.

Any non-commiſſioned officer or ſoldier, who ſhall, without leave from his commanding-officer, abſent himſelf from his troop or company, or from any detachment with which he ſhall be commanded, ſhall, upon being convicted thereof, be puniſhed according to the nature of the offence, at the diſcretion of a court-martial.

No non-commiſſioned officer or ſoldier ſhall inliſt himſelf in any other regiment, troop, or company, without a regular diſcharge from the regiment, troop, or company, in which he laſt ſerved, on the penalty of being reputed a deſerter, and ſuffering accordingly: and in caſe any officer ſhall knowingly receive and entertain ſuch non-commiſſioned officer or ſoldier, or ſhall not, after his being diſcovered to be a deſerter, immediately confine him, and give notice thereof to the corps in which he laſt ſerved, he the ſaid officer ſo offending ſhall by a court-martial be caſhiered.

Whatſoever officer or ſoldier ſhall be convicted of having adviſed any other officer or ſoldier to deſert our ſervice, ſhall ſuffer ſuch puniſhment as ſhall be inflicted upon him by the ſentence of a court-martial.

Juſtices may commit DESERTERS. And whereas ſeveral ſoldiers, being duly liſted, do afterwards deſert, and are often found wandering, or otherwiſe abſenting themſelves illegally from his majeſty's ſervice; it is hereby further enacted, that it ſhall and may be lawful to and for the conſtable, headborough, or tythingman of the town and place, where any perſon, who may be reaſonably ſuſpected to be ſuch a deſerter, ſhall be found, to apprehend, or cauſe him to be apprehended, and to cauſe ſuch perſon to be brought before any juſtice of the peace, living in or near ſuch town or place, who hath hereby power to examine ſuch ſuſpected perſon: and if by his confeſſion, or the teſtimony of one or more witneſs or witneſſes upon oath, or by the knowledge of ſuch juſtice of the peace, it ſhall appear, or be found, that ſuch ſuſpected perſon is a liſted ſoldier, and ſhould be with the troop or company to which he belongs; ſuch juſtice of the peace ſhall forthwith cauſe him to be conveyed to the gaol of the country or place where he ſhall be found, or to the houſe of correction, or other public priſon, in ſuch town or place where ſuch deſerter ſhall be apprehended; or to the Savoy, in caſe ſuch deſerter ſhall be apprehended within the city of London or Weſtminſter, or places adjacent; and tranſmit an account thereof to the ſecretary at war for the time being, to the end ſuch perſon may be proceeded againſt according to law: and the keeper of ſuch gaol, houſe of correction, or priſon, ſhall receive the full ſubſiſtence of ſuch deſerter or deſerters, during the time that he or they ſhall continue in his cuſtody, for the maintenance of the ſaid deſerter or deſerters; but ſhall not be intitled to any fee or reward, on account of the impriſonment of ſuch deſerter or deſerters, any law, uſage, or cuſtom to the contrary notwithſtanding.

Reward for taking up DESERTERS. And for the better encouragement of any perſon or perſons to ſecure or apprehend ſuch deſerters as aforeſaid; be it further enacted by the authority aforeſaid, that ſuch juſtice of the peace ſhall alſo iſſue his warrant in writing to the collector or collectors of the land-tax money of the pariſh or townſhip where ſuch deſerter ſhall be apprehended, for paying, out of the land-tax money ariſing or to ariſe in the year 1778, into the hands of ſuch perſon who ſhall apprehend, or cauſe to be apprehended, any deſerter from his majeſty's ſervice, the ſum of 20s. for every deſerter that ſhall be ſo apprehended and committed; which ſum of 20s. ſhall be ſatisfied by ſuch collector, to whom ſuch warrant ſhall be directed, and allowed upon his account.

Penalty for concealing DESERTERS, or *buying their arms, clothes*, &c. Provided always, that if any perſon ſhall harbour, conceal, or aſſiſt any deſerter from his majeſty's ſervice, knowing him to be ſuch, the perſon ſo offending ſhall forfeit, for every ſuch offence, the ſum of 5l. or if any perſon ſhall knowingly detain, buy, or exchange, or otherwiſe receive, any arms, clothes, caps, or other furniture belonging to the king, from any ſoldier or deſerter, or any other perſon, upon any account or pretence whatſoever, or cauſe the colour of ſuch clothes to be changed; the perſon ſo offending, ſhall forfeit for every ſuch offence the ſum of 5l. and upon conviction by the oath of one or more credible witneſs or witneſſes, before any of his majeſty's juſtices of the peace, the ſaid reſpective penalties of 5l. and 5l. ſhall be levied by warrant under the hands of the ſaid juſtice or juſtices of the peace, by diſtreſs and ſale of the goods and chattles of the offender; one moiety of the ſaid firſt-mentioned penalty of 5l. to be paid to the informer, by whoſe means ſuch deſerter ſhall be apprehended; and one moiety of the ſaid laſt-mentioned penalty of 5l. to be paid to the informer; and the reſidue of the ſaid reſpective penalties to be paid to the officer to whom any ſuch deſerter or ſoldier did belong: and in caſe any ſuch offender, who ſhall be convicted, as aforeſaid, of harbouring or aſſiſting any ſuch deſerter or deſerters; or having knowingly received any arms, clothes, caps, or other furniture belonging to the king; or having cauſed the colour of ſuch clothes to be changed, contrary to the intent of this act, ſhall not have ſufficient goods and chattles, whereon diſtreſs may be made, to the value of the penalties recovered againſt him for ſuch offence, or ſhall not pay ſuch penalties within 4 days after ſuch conviction; then, and in ſuch caſe, ſuch juſtice of the peace ſhall and may, by warrant under his hand and ſeal, either commit ſuch offender to the common gaol, there to remain without bail or mainpriſe for the ſpace of three months, or cauſe ſuch offender to be publicly whipped, at the diſcretion of ſuch juſtice.

DESIGN, in a *general ſenſe*, implies the plan, order, repreſentation, or conſtruction of any kind of military building, chart, map, or drawing, &c. In building, the term *ichnography* may be uſed, when by deſign is only meant the plan of a building, or a flat figure drawn on paper: when ſome ſide or face of the building is raiſed from the ground, we may uſe the term *orthography*; and when both front and ſides are ſeen in perſpective, we may call it *ſcenography*.

DESIGNING, the art of delineating or drawing the appearance of natural objects, by lines on a plane.

DETACHED *pieces*, in *fortification*, are ſuch out-works as are detached, or at a diſtance from the body of the place; ſuch as half-moons, ravelines, baſtions, &c.

DETACHMENT, in *military affairs*, an uncertain number of men drawn out from ſeveral regiments or companies equally, to march or be employed as the general may think proper, whether on an attack, at a ſiege, or in parties to ſcour the country. A detachment of 2000 or 3000 men is a command for a general officer; 800 for a colonel, 500 for a lieutenant-colonel, 200 or 300 for a major, 80 or 100 for a captain, 40 for a lieutenant or enſign, 12 for a ſerjeant, and 6 for a corporal. Detachments are ſometimes made of intire ſquadrons and battalions. One general rule, in all military projects that depend upon us alone, ſhould be to omit nothing that can inſure the ſucceſs of our detachment and deſign; but, in that which depends upon the enemy, to truſt ſomething to hazard.

DETAIL *of duty*, in *military affairs*, is a roſter or table for the regular and exact performance of duty, either in the field, garriſon, or cantonments. The general detail of duty is the proper care of the majors of brigade, who are guided by the roſter for the officers, and by the tables for the men, to be occaſionally furniſhed.

DEVASTATION, in *military hiſtory*, the act of deſtroying, laying waſte, demoliſhing or unpeopling towns, &c.

DIAMETER, in both a *military* and *geometrical ſenſe*, implies a right line paſſing through the centre of a circle, and terminating at each ſide by the circumference thereof. See CIRCLE.

The impoſſibility of expreſſing the exact proportion of the diameter of a circle to its circumference, by any received way of notation, and the abſolute neceſſity of having it as near the truth as poſſible, has put ſome of the moſt celebrated men in all ages upon endeavouring to approximate it. The firſt who attempted it with ſucceſs, was the celebrated Van Culen, a Dutch-man, who, by the ancient method, though ſo very laborious, carried it to 36 decimal places: theſe he ordered to be engraven on his tomb-ſtone, thinking he had ſet bounds to improvements. However, the indefatigable Mr. Abraham Sharp carried it to 75 places in decimals; and ſince that, the learned Mr. John Machin has carried it to 100 places, which are as follow:

If the diameter of a circle be 1, the circumference will be 3.1415926535,8979323846, 2643383279,5028841971,6939937510,5820974944,5923078164,0628620899,8628034825,3421170679, + of the ſame parts; which is a degree of exactneſs far ſurpaſſing all imagination.

But the ratios generally uſed in the practice of military mathematics are theſe following. The diameter of the circle is to its circumference as 113 is to 355 nearly.—The ſquare of the diameter is, to the area of the circle, as 452 to 355.—The cube of the diameter is, to the ſolid content of a ſphere, as 678 to 355.—The cubes of the axes are, to the ſolid contents of equi-altitude cylinders, as 452 to 355.—The ſolid content of a ſphere is, to the circumſcribed cylinder, as 2 to 3—.

How to find the Diameter *of ſhot or ſhells.* For an iron ball, whoſe diameter is given, ſuppoſing a 9-pounder, which is nearly 4 inches, ſay, the cube root of 2.08 of 9 pounds is, to 4 inches, as the cube root of the given weight is to the diameter ſought. Or, if 4 be divided by 2.08, the cube root of 9, the quotient 1.923 will be the diameter of a 1-pound ſhot; which being continually multiplied by the cube root of the given weight, gives the diameter required..

Or by logarithms much ſhorter, thus. If the logarithm of 1.923, which is .283979, be conſtantly added to the third part of the logarithm of the weight, the ſum will be the logarithm of the diameter. Suppoſe a ſhot to weigh 24 pounds: add the given logarithm .283979 to the third part of .460070 of the logarithm 1.3802112 of 24, the ſum .7440494 will be the logarithm of the diameter of a ſhot weighing 24 pounds, which is 5.5468 inches.

If the weight ſhould be expreſſed by a fraction, the rule is ſtill the ſame: for inſtance, the diameter of a 1½ pound ball, or $\frac{3}{2}$, is found by adding the logarithm .2839793, found above, to .0586971 $\frac{1}{3}$ of the logarithm of $\frac{3}{2}$, the ſum .3426764 will be the logarithm of the diameter required, i. e. 2.2013 inches.

As the diameter of the bore, or the caliber of the piece, is made $\frac{1}{20}$ part larger than that of the ſhot, according to the preſent practice, the following table is computed.

Diameters *of the ſhots and calibers of Engliſh guns.*

lb.	0	1	2	3	4	5	6	7	8	9	
0	0	1.923	2.423	2.775	3.053	3.288	3.498	3.679	3.846	4.000	Diam.
	0	2.019	2.544	2.913	3.204	3.568	3.668	3.861	4.038	4.200	Calib.
1	4.143	4.277	4.403	4.522	4.635	4.743	4.846	4.945	5.040	5.131	Diam.
	4.349	4.490	4.623	4.748	4.866	4.981	5.088	5.192	5.292	5.368	Calib.
2	5.220	5.305	5.388	5.409	5.547	5.623	5.697	5.769	5.839	5.908	Diam.
	5.480	5.570	5.661	5.742	5.824	5.893	5.982	6.057	6.129	6.203	Calib.
3	5.975	6.041	6.105	6.168	6.230	6.290	6.350	6.408	6.465	6.521	Diam.
	6.273	6.343	6.410	6.475	6.541	6.604	6.666	6.707	6.788	6.846	Calib.
4	6.576	6.631	6.684	6.737	6.789	6.640	6.890	6.940	6.989	7.037	Diam.
	6.904	6.962	7.018	7.076	7.128	7.182	7.234	7.287	7.338	7.383	Calib.

Explanation.

The numbers in the firſt horizontal line are units, and thoſe in the firſt vertical column tens; the other numbers, under the one, and oppoſite to the others, are the reſpective diameters of ſhot and calibers. Thus, to find the diameter of the ſhot, and the caliber of a 24-pounder, look for the number 2 on the left-hand ſide, and for 4 at top; then the number 5.547, under 4, and oppoſite 2, will be the diameter of the ſhot in inches and decimals, and the number 5.824, under the firſt, the caliber of a 24-pounder, &c.

Diameters *of leaden bullets from* 1 *to* 29 *in the pound.*

	0	1	2	3	4	5	6	7	8	9
0	0	1.671	1.326	1.158	1.05	.977	.919	.873	.835	.803
1	.715	.751	.730	.711	.693	.677	.663	.650	.637	.626
2	.615	.605	.596	.587	.579	.571	.564	.557	.550	.544
3	.538	.536	.526	.521	.517	.511	.506	.501	.497	.493

The diameters of muſket bores differ about 1-20th part from that of the bullet. The government allows 11 bullets in the pound, for the proof of muſkets, and 14 in the pound, or 29 in 2 pounds, for ſervice; 17 for the proof of carbines, and 20 for ſervice; 28 in the pound for proof of piſtols, and 34 for ſervice.

Diameter *of powder meaſures.* See Powder Measures.

DIGGING. See Mining.

DIKE. See Ditch. See Fortification.

DIMACHÆ, in *ancient military affairs*, were a kind of horſemen, anſwering to the dragoons of the moderns.

DIRECTION, in *military mechanics*, ſignifies the line or path of a body in motion, along which it endeavours to proceed, according to the force impreſſed upon it.

Angle of Direction, that formed by the lines of direction of two conſpiring powers.

Quantity of Direction, a term uſed by military mathematicians for the product of the velocity of the common centre of gravity of a ſyſtem of bodies, by the ſum of their quantities of matter: this is no ways altered by any colliſions among the bodies themſelves.

DIRK, a kind of dagger uſed by the highlanders in Scotland, which they generally wear ſtuck in their belts.

DISCHARGE, in a *military ſenſe*, is the diſmiſſing a ſoldier from the troop or company he belonged to, either by his own requeſt, or when, after long and faithful ſervices, he is diſcharged, and intitled to his majeſty's bounty.

DISCIPLINE, in a *general ſenſe*, ſignifies inſtruction and government.

Military Discipline.} By *military conſtitution* is meant, the au-
Military conſtitution.} thoritative declared laws for the guidance of all military men, and all military matters; and by *diſcipline* is meant, the obedience to, and exerciſe of, thoſe laws. As health is to the natural body, ſo is a ſound military conſtitution to the military one; and as exerciſe is to the firſt, ſo is diſcipline to the laſt. Bravery will perchance gain a battle; but every one knows it muſt be training and diſcipline that will, and muſt win the long-diſputed prize of a war.

The kingdom of Pruſſia is an example extant in favour of diſcipline; for ſince that ſtate has raiſed an army, and maintained that army in ſtrict diſcipline, it has held a very conſiderable ſhare in the ſyſtem of Europe; and ſhould it neglect its army, it will ſink from the kingdom of Pruſſia, into the electorate of Brandenburgh.

Marine Discipline, is the training up ſoldiers for ſea-ſervice, in ſuch exerciſes as the various poſitions of the firelock and body; and teaching them every manœuvre that can be performed on board ſhips of war at ſea, &c.

DISMOUNTING, in a *military ſenſe*, is the act of unhorſing. Thus, to diſmount the cavalry, &c. is to make them alight.

To Dismount *cannon*, is to break their carriages, wheels, axle-trees, or any thing elſe, ſo as to render them unfit for ſervice. It alſo implies diſmounting by the gin, &c.

DISPART, in *gunnery*, is to ſet a mark on the muzzle-ring, ſo that it may be of an equal height with the baſe-ring: hence a line drawn between them, will be parallel to the axis of the concave cylinder, for the gunner to take aim by it, to hit the mark he is to fire at; for the bore and this imaginary line being parallel, the aim ſo taken muſt be true. This exactneſs cannot be made uſe of in an engagement, and but very ſeldom at a ſiege; for there practice and the eye muſt be the only guides.

Dispart-*frontlet.* See Frontlet.

DISPOSITION, in a *military ſenſe*, is the juſt placing an army or body of men upon the moſt advantageous ground, and in the ſtrongeſt ſituation for a vigorous defence.

DISTANCE *of the baſtions*, in *fortification*, is the ſide of the exterior polygon. See Fortification.

DITCH. See Fortification.

To drain a Ditch, is to make the water run off into lower ground, by means of ſmall trenches cut for this purpoſe.

DIVERSION, in *military hiſtory*, is when an enemy is attacked in one place where they are weak and unprovided, in order to draw off their forces from making an irruption ſomewhere elſe. See Stratagems.

DIVISIONS *of a battalion*, are the ſeveral platoons into which a regiment or battalion is divided, either in marching or firing; each of which is commanded by an officer.

Divisions *of an army*, are the number of brigades and ſquadrons it contains.

DIVINE *ſervice*, in the *army*, is or ſhould be performed every Sunday by the chaplain of the regiment, not purely on a moral, but pretty much on a political account.—All officers and ſoldiers, not having juſt impediment, ſhall diligently frequent divine ſervice and ſermon, in the places appointed for the aſſembling of the regiment, troop, or company, to which they belong: ſuch as wilfully abſent themſelves, or, being preſent, behave indecently or irreverently, ſhall, if commiſſioned officers, be brought before a court-martial, there to be publicly and ſeverely reprimanded by the preſident: of non-commiſſioned officers or ſoldiers, every perſon ſo offending, ſhall, for his firſt offence, forfeit 12d. to be deducted out of his next pay; for the ſecond offence, he ſhall not only forfeit 12d. but be laid in irons for 12 hours, &c. *Art. of war.*

DODECAGON, in *geometry*, is a regular polygon, conſiſting of 12 equal ſides and angles, capable of being regularly fortified with the ſame number of baſtions.

DOG-*nails*. See Nails.

DOLPHINS. See Cannon.

DOSSER, in *military matters*, is a ſort of baſket, carried on the ſhoulders of men, uſed in carrying the earth from one part of a fortification to another, where it is wanted.

DOWLEDGES,
DOWL-*bars*, } See Carriages.
Dowl-*pins*,

DOUBLE *tenaille*. See Tenaille.

DOUBLING, in the *military art*, is the placing two or more ranks or files into one.

DOUBLE *your ranks*, is for the 2d, 4th, and 6th ranks (when ſo drawn up) to march into the 1ſt, 3d, and 5th; ſo that of 6 ranks they are made but 3; which is not ſo when they double by half-files, becauſe then 3 ranks ſtand together, and the 3 other come up to double them; that is, the 1ſt, 2d, and 3d, are doubled by the 4th, 5th, and 6th, or the contrary.

Double *your files*, is for every other file to march into that which is next to it, on the right or left, as the word of command directs; and then the 6 ranks are doubled into 12, the men ſtanding 12 deep; and the diſtance between the files is double what it was before. By this method 3 files may be doubled into 6, &c.

DRAGOONS, in *military affairs*, are a kind of horſemen, or cavalry, who ſerve both on horſeback and foot; being always ready on every emergency, as being able to keep pace with the horſe, and do the duty of foot. In battle, or on attacks, they generally fight ſword in hand after the firſt fire. In the field they incamp on the right and left of the lines. They are divided into brigades, regiments, and ſquadrons. Their martial muſic is drums and trumpets. The firſt regiment of dragoons raiſed in England was in 1681, and called the royal regiment of dragoons of North Britain. This name is derived from the Latin word *Draconarii*, uſed amongſt the Romans.

DRAG-*ropes*. See Ropes.

DRAUGHT-*hooks*, in a *gun-carriage*, are fixed to the tranſom-bolts on the cheeks of artillery carriages, near the trunnion-holes and trails: they are uſed to draw the guns backwards and forwards by men with drag-ropes fixed to thoſe hooks. See Carriage.

DRAW-*bridge*. See Bridge.

DRAWING, in a *military ſenſe*, is the art of repreſenting the appearances of all kinds of military objects by imitation, or copying, both with and without the aſſiſtance of mathematical rules.

DRAIN, or DREIN, in the *military art*, is a trench made to draw the water out of a ditch, which is afterwards filled with hurdles and earth, or with faſcines, or bundles of ruſhes and planks, to facilitate the paſſage over the mud. See Trench.

DRESS-*military*. The clothing of the army is generally called regimentals, every part of which ſhould facilitate, and not hinder, the various motions of the manual exerciſe. A ſoldier, without regard to faſhion or taſte, (to uſe the words of a modern author) ſhould be dreſſed in the moſt comfortable and leaſt embarraſſing manner poſſible; and the keeping him warm, and leaving him the entire uſe of his limbs, are objects always to be had in view.

DRINKING to exceſs in the army is at all times highly criminal, but upon ſervice, is not to be pardoned; and the conſequence will be a trial by a court-martial. It has been productive of almoſt innumerable miſchiefs, and is a moſt deteſtable and horrid practice. What ever commiſſioned officer ſhall be found drunk on his guard, party or other duty, under arms, ſhall be caſhiered for it; any non-commiſſioned officer or ſoldier, ſo offending, ſhall ſuffer ſuch corporal puniſhment as ſhall be inflicted by the ſentence of a court-martial. *Art. of war.*

DRUM, is a martial muſical inſtrument in form of a cylinder, hollow within, and covered at the two ends with vellum, which is ſtretched or ſlackened at pleaſure, by means of ſmall cords and ſliding leathers. This inſtrument is uſed both by foot and dragoons; which is done in ſeveral manners, either to give notice to the troops of what they are to do, or to demand liberty to make ſome propoſal to an enemy. Every troop of dragoons, and every company of foot or artillery, has two or more drums, as the men are in number. The drum was firſt invented by Bacchus, who, as Polyenus reporteth, fighting againſt the Indians, gave the ſignal of battle with cymbals and drums; and the Saracens, who invaded Chriſtendom, introduced the drum into the European armies. The various beats are as follow, viz.

The general, is to give notice to the troops that they are to march.

The aſſembly, } is to order the troops to repair
The troop, } to the place of rendezvous, or
to their colours.

The march, is to command them to move, always with the left foot firſt.

Tat-too, is to order all to retire to their quarters.

The reveille, is always beat at break of day, and is to warn the ſoldiers to riſe, and the centinels to forbear challenging, and to give leave to come out of quarters.

To arms, is for ſoldiers who are diſperſed, to repair to them.

The retreat, is a ſignal to draw off from the enemy.

Retraite, is always beat in both camp and garriſon a little before ſun-ſet, at which time the gates are ſhut, and the ſoldiers repair to their barracks.

The alarm, is to give notice of ſudden danger, that all may be in readineſs for immediate duty.

The parley, } is a ſignal to demand ſome
The chamade, } conference with the enemy.

Drum, or Drummer, the perſon who beats the drum.

Kettle-Drums, are two ſorts of large baſons of copper or braſs, rounded at the bottom, and covered with vellum or goat-ſkin, which is kept faſt by a circle of iron, and ſeveral holes faſtened to the body of the drum, and a like number of ſcrews to ſtretch it at pleaſure. They are uſed among the horſe. The *kettle-drum* belonging to the royal regiment of artillery is mounted on a moſt ſuperb and pompous waggon, richly gilt and ornamented, and drawn by 4 white horſes elegantly capariſoned, with a ſeat for the drum-major-general.

Drum-*major*, is always that perſon in the regiment, who beats the beſt drum, has the command over the other drums, and teaches them their duty. Every regiment has a drum-major.

DUEL, is a ſingle combat, at a time and place appointed, in conſequence of a cartel or challenge. Duelling was anciently authoriſed; but the motive of the duelliſts was the good of their country, when one, or a ſmall number of combatants were choſen to ſave the blood of a whole army, and decide, by victory or death, the quarrels of kings or nations. Thus it was with Goliah and David, the Horatii and Curatii, and ſeveral others.

Duelling was ſo general a method of determining differences among the nobles, that even eccleſiaſtics were not excuſed; only, to prevent their being ſtained with blood, they procured champions to fight for them. None were excepted from combat, but ſick people, cripples, and ſuch as were under 21 years of age, or above 60. Juſts and tournaments, doubtleſs, rendered duels more frequent.—No officer or ſoldier ſhall pretend to ſend a challenge to any other officer or ſoldier, to fight a duel, if a commiſſioned officer, on pain of being caſhiered; if a non-commiſſioned officer or ſoldier, of ſuffering corporal puniſhment, at the diſcretion of a court-martial. *Art. of war.*

Duelling was authoriſed before the Normans came into England, though not ſo frequent and ſolemn as after the conqueſt.

DUNGEON, } in *fortification*, is commonly
DONJON, } a large tower or redout of a
fortreſs, whither the garriſon may retreat, in caſe of neceſſity, and capitulate with greater advantage.

DUTY, in a *military ſenſe*, is the exerciſe of thoſe functions that belong to a ſoldier; yet with this nice diſtinction, that duty is counted the mounting guard, &c. where no enemy is directly to be engaged; for when any body of men marches to meet the enemy, this is ſtrictly called *going upon ſervice*.

On all duties, whether with or without arms, picquets, or court-martials, the tour of duty begins with the eldeſt downwards. An officer who is upon duty cannot be ordered for any other before that duty is finiſhed, except he be on the picquet, as then he ſhall be relieved, and go on that duty ordered.

E

EAGLE. *Black*-EAGLE, an order of military knighthood in Pruſſia, inſtituted by the elector of Brandenbourg, in 1701, on his being crowned king of Pruſſia. The knights of this order wear an orange-coloured ribbon, ſuſpending a black eagle.

White-EAGLE, is a like order in Poland, inſtituted in 1325, by Uladiſlaus V. on occaſion of the marriage of his ſon Caſimir to the daughter of the great duke of Lithuania. The knights of this order wear a chain of gold, ſuſpending a ſilver eagle crowned.

EARTH-*bags*. See BAGS.

ECHARPE, in the *art military*. To batter *en echarpe*, is to fire obliquely, or ſideways. See BATTERY.

ECHAUGETTE, in *military hiſtory*, ſignifies a watch-tower, or kind of centry box.

ECHO. See SOUND.

EDUCATION, in a *military ſenſe*, implies the training up of youth to the art of war; wherein, firſt, ſhould be underſtood, whether nature has given the young man the talents neceſſary for the profeſſion or not; for here ſenſe, parts, courage, and judgement, are required in a very eminent degree. The natural qualities of an officer, are, a robuſt conſtitution, a noble open countenance, a martial genius, fire to puſh action, phlegm to moderate his tranſports, and patience to ſupport the toils and fatigues of war, without almoſt ſeeming to feel them. Birth and family, added to theſe advantages, never fail of commanding reſpect. Acquired qualities of an officer conſiſt in moral virtues and ſciences: by the firſt is meant, a regular good conduct, œconomy, prudence, and a ſerious application to what regards the ſervice. Military ſciences indiſpenſibly demand the reading of ancient and modern hiſtorians; a good knowledge of military mathematics, and the ſtudy of the chief languages of Europe.

It is in ancient authors we find all that is excellent, either in politics or war: the make and form of arms are changed ſince the invention of gun-powder; but the ſcience of war is always the ſame. On one hand, hiſtory inſtructs us by examples, and furniſhes us with proofs, of the beautiful maxims of virtue and wiſdom, which morality has taught us: it gives us a kind of experience, before-hand, of what we are to do in the world; it teaches us to regulate our life, and conduct ourſelves with wiſdom; to diſtruſt mankind; ever to carry ourſelves with integrity and probity, never to do a mean action; and to meaſure grandeur with the level of reaſon, that we may deſpiſe it when dangerous or ridiculous.

On the other hand, hiſtory ſerves to give us a knowledge of the univerſe, and the different nations which inhabit it, their religions, their governments, their intereſts, their commerce, their politicks, and the law of nations. It ſhews us the origin of the illuſtrious houſes who have reigned in the world, and given birth to thoſe who ſtill ſubſiſt.

The knowledge of military mathematicks, regards the operations of war in general; every thing there conſiſts in proportion, meaſure, and motion: it treats of marches, encampments, battles, artillery, fortification, lines, ſieges, mines, ammunition, proviſions, fleets, and every thing which regards war; but no juſt notion can be acquired without geometry, natural philoſophy, mechanics, military architecture, and the art of drawing.

The ſtudy of languages is moſt uſeful to an officer, and he feels the neceſſity of it, in proportion as he riſes to higher employments. Thus the Latin, German, and French languages, are very neceſſary for an Engliſh officer; as the Engliſh, French, and Italian, are for a German.

EFFECTIVE *men*, in a *military ſenſe*, are ſoldiers fit for ſervice; as an army of 30,000 effective (fighting) men.

ELDER *battalion*. A battalion is counted elder than another, by the time ſince it was raiſed. See SENIORITY.

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ELDER *officer*, is he whoſe commiſſion bears the oldeſt date. See SENIORITY.

ELEVATION, in *gunnery*, that comprehended between the horizon and the line of direction of either cannon or mortar; or it is that which the chace of a piece, or the axis of its hollow cylinder, makes with the plane of the horizon.

EMBRASURE, in *fortification*, is an opening, hole, or aperture in a parapet, through which the cannon are pointed to fire at the enemy. They are generally made from 10 to 12 feet diſtant from one another, every one of them being from 6 to 9 feet wide without, and 2 or 2½ within: their height above the platform is 2½ or 3 feet towards the town, and 1½ foot on the other ſide towards the field, ſo that the muzzle of the piece may be ſunk on occaſion, and brought to fire low. See BATTERY. See FORTIFICATION.

EMINENCE, in the *military art*, a high or riſing ground, which overlooks and commands the low places about it: ſuch places, within cannon-ſhot of any fortified place, are a great diſadvantage; for if the beſiegers become maſters of them, they can from thence fire into the place.

EMPATTEMENT, in *fortification*. See TALUS.

EMULATION, in a *military ſenſe*, is a noble jealouſy whereby gentlemen endeavour to ſurpaſs each other in the art of war, and military ſciences. Is not the want of encouragement to excite emulation, the great cauſe of miſconduct among military men? An officer who is not protected, who is never ſure of the leaſt favour, neglects himſelf, and takes leſs trouble to acquire glory, rarely heard of, though merited by the braveſt actions, than to enjoy the tranquillity of an ordinary reputation. Brave actions, whoever are the authors, ſhould never be buried in oblivion, as they excite emulation, and are full of inſtruction.

ENCAMPMENT, the pitching of a camp. See CAMP.

ENCEINTE, in *fortification*, is the interior wall or rampart which ſurrounds a place, ſometimes compoſed of baſtions or curtains, either faced or lined with brick or ſtone, or only made of earth. The *enceinte* is ſometimes only flanked by round or ſquare towers, which is called a Roman wall.

ENCOUNTERS, in *military affairs*, are combats, or fights, between two perſons only. Figuratively, battles or attacks by ſmall or large armies. The marquis de Feuquieres mentions four inſtances of particular encounters brought on by entire armies, with a deſign to create a general engagement, Engliſh edition, vol. 1. p. 304. &c.

ENEMY, in a *military ſenſe*, one who is of an oppoſite ſide in war, or who publickly invades the kingdom.

ENFANS *perdus*, in *military hiſtory*, are ſoldiers detached from ſeveral regiments, or otherwiſe appointed to give the firſt onſet in battle, or an attack upon the counterſcarp, or the breach of a place beſieged; ſo called (by the French) becauſe of the imminent danger they are expoſed to.

ENFILADE, in *fortification*, is uſed in ſpeaking of trenches, or other places, which may be ſcoured by the enemy's ſhot, along their whole length. In conducting the approaches at a ſiege, care muſt be taken that the trenches be not *enfiladed* from any work of the place. See TRENCHES.

To ENFILADE, is to ſweep the whole length of any work or line of troops with the ſhot of artillery or ſmall arms.

ENGINES, in *military mechanics*, are compound machines, made of one or more mechanical powers, as levers, pullies, ſcrews, &c. in order to raiſe, project, or ſuſtain any weight, or produce any effect which could not be eaſily effected otherwiſe. Engines uſed in war are extremely numerous, as the battering-ram, balliſta, waggons, chariots, &c.

ENGINE, *to drive fuzes*, conſiſts of a wheel with a handle to it, to raiſe a certain weight, and to let it fall upon the driver, by which the ſtrokes become more equal.

ENGINE *to draw fuzes*, has a ſcrew fixed upon a three-legged ſtand, the bottom of which has a ring to place it upon the ſhell; and at the end of the ſcrew is fixed a hand-ſcrew by means of a collar, which being ſcrewed on the fuze, by turning the upper ſcrew, draws out or raiſes the fuze.

ENGINEER, is commonly applied to an officer who is appointed to inſpect and contrive any attacks, defences, &c. of a fortified place, or to build or repair them, &c.

The art of fortification is an art which ſtands in need of ſo many others, and whoſe object is ſo extenſive, and its operations accompanied with ſo many various circumſtances, that it is almoſt impoſſible for a man to make himſelf maſter of it by experience alone, even ſuppoſing him born with all the advantages of genius and diſpoſition poſſible for the knowledge

ledge and practice of that important art. We do not pretend to deny that experience is of greater efficacy than all the precepts in the world; but it has likewiſe its inconveniences as well as its advantages: its fruits are of ſlow growth; and whoever is content with purſuing only that method of inſtruction, ſeldom knows how to act upon emergencies of all kinds, becauſe old age incapacitates him from exerciſing his employment. Experience teaches us, thro' the means of theſe errors we commit ourſelves, what theory teaches us at the expence of others. The life of man being ſhort, and opportunities of practice ſeldom happening, it is certain nothing leſs than a happy genius, a great ſhare of theory, and intent application joined to experience, can make him one day ſhine in his profeſſion. From whence it follows, that leſs than the three firſt of thoſe four qualities, ſhould not be a recommendation for the reception of a young gentleman into the corps of engineers.

The fundamental ſciences, and thoſe abſolutely neceſſary, are arithmetic, geometry, mechanics, hydraulics, and drawing. Without arithmetic it is impoſſible to make a calculation of the extent, and to keep an account of the diſburſements made, or to be made; nor without it can an exact computation be made upon any occaſion whatſoever.

Without geometry it is impoſſible to lay down a plan or map with truth and exactneſs, or ſettle a draught of a fortification, or calculate the lines and angles, ſo as to make a juſt eſtimation, in order to trace them on the ground, and to meaſure the ſurface and ſolidity of their parts.

Mechanics teach us the proportions of the machines in uſe, and how to increaſe or diminiſh their powers as occaſion may require; and likewiſe to judge whether thoſe which our own imagination ſuggeſts to us, will anſwer in practice.

Hydraulics teach us how to conduct waters from one place to another, to keep them at a certain height, or to raiſe them higher.

How fluently ſoever we may expreſs ourſelves in ſpeaking or writing, we can never give ſo perfect an idea as by an exact drawing: and often in fortification both are wanted; for which reaſon the art of drawing is indiſpenſably neceſſary for engineers.

To the qualities above mentioned muſt be added activity and vigilance; both which are abſolutely neceſſary in all operations of war, but eſpecially in the attack of ſuch places as are in expectation of ſuccours. The beſieged muſt have no time allowed them for conſideration; one hour loſt at ſuch a juncture often proves irreparable. It is by their activity and vigilance that engineers often bring the beſieged to capitulate, much ſooner than they would have done if thoſe engineers had not puſhed on the attack with firmneſs and reſolution. Want of vigilance and activity often proceed from irreſolution, and that from weakneſs of capacity.

As the office of an engineer requires great natural qualifications, much knowledge, ſtudy, and application, it is but reaſonable that the pay ſhould be proportioned to that merit which is to be the qualification of the perſon employed: he muſt be at an extraordinary expence in his education, and afterwards for books and inſtruments for his inſtruction and improvement, as well as for many other things; and that he may be at liberty to purſue his ſtudies with application, he muſt not be put to ſhifts for neceſſaries. It ſhould likewiſe be conſidered, that if an engineer do his duty, be his ſtation what it will, his fatigue muſt be very great; and, to dedicate himſelf wholly to that duty, he ſhould be diveſted of all other cares.

The word Engineer is of modern date, and was firſt uſed about the year 1650, when one Capt. Thomas Rudd had the title of chief engineer to the king. In 1600 the title given to engineers was trench-maſter; and in 1622 Sir William Pelham, and after him Sir Francis Vere, acted as trench-maſters in Flanders. In the year 1634 an engineer was called camp-maſter general, and ſometimes engine-maſter, being always ſubordinate to the maſter of the ordnance.

At preſent the corps of engineers conſiſts of

1 Colonel in chief;
2 Directors, or lieutenant-colonels;
4 Sub-directors, or majors;
12 Engineers in ordinary, or captains;
12 Engineers extraordinary, or captains;
14 Sub-engineers, or lieutenants;
24 Practitioner engineers, or ſecond lieutenants; excluſive of the engineers on the Iriſh eſtabliſhment, which are but few.

ENNEAGON, in *geometry*, or *fortification*, is a figure conſiſting of 9 angles, and as many ſides, capable of being fortified with the ſame number of baſtions.

ENSIGN, in the *military art*, a banner, under which the ſoldiers are ranged according to the different regiments they belong to. See Colours.

Ensign, or *enſign-bearer*, is an officer who carries the colours, being the loweſt commiſſioned officer in a company of foot, ſubordinate to the captain and lieutenant. The word enſign is very ancient, being uſed both by the Greeks and Romans, and amongſt both foot and horſe. Enſigns belonging to the foot, were either the common one of the whole legion, or the particular ones of the manipuli. The common enſign of the whole legion was an eagle of gold or ſilver fixed on the top of a ſpear, holding a thunderbolt in her talons, as ready to deliver it. That this was not peculiar to the Romans, is evident from the teſtimony of Xenophon, who informs us, that the royal enſign of Cyrus was a golden eagle ſpread over a ſhield, and faſtened on a ſpear, and that the ſame was ſtill uſed by the Perſian kings. In the ruſtic age of Rome, the enſigns were nothing more than a wiſp of hay carried on a pole, as the word *manipulus* properly ſignifies. The enſign of the horſe was not ſolid, as the others, but a cloth, ſomewhat like our colours, ſpreading on a ſtaff; on which the names of the emperors were generally depicted. The religious care the ſoldiers took of the enſigns, was extraordinary: they worſhipped them, ſwore by them (as at preſent ſeveral European powers do) and incurred certain death if they loſt them. The Turks and Tartars make uſe of horſes tails for their enſigns, whoſe number diſtinguiſhes the rank of their commanders; for the Sultan has 7, and the Grand Vizier only 3, &c.

ENTERPRISE, in *military hiſtory*, an undertaking attended with ſome hazard and danger.

ENTERPRISER, an officer who undertakes or engages in any important and hazardous deſigns. This kind of ſervice frequently happens to the light-infantry, light-horſe, and huſſars.

ENVELOPE, in *fortification*, a work of earth, ſometimes in form of a ſingle parapet, and at others like a ſmall rampart: it is raiſed ſometimes in the ditch, and ſometimes beyond it. They are ſometimes *en zic-zac*, to incloſe a weak ground, where that is practicable, with ſingle lines, to ſave the great charge of horn-works, crown works, and tenailles, or where room is wanting for ſuch large works. Theſe ſorts of works are to be ſeen at Beſançon, Dovay, Luxembourg, &c. Envelopes in a ditch are ſometimes called ſillons, contre-gardes, conſerves, lunettes, &c. which words ſee.

EPAULE, in *fortification*, denotes the ſhoulder of a baſtion, or the place where its face and flank meet, and from the angle, called the angle of the ſhoulder. See FORTIFICATION.

EPAULEMENT, in *fortification*, is a kind of breaſt-work to cover the troops in front, and ſometimes in flank. In a ſiege, the beſiegers generally raiſe an epaulement of 8 or 10 feet high, near the entrance of the approaches, to cover the cavalry, which is placed there to ſupport the guard of the trenches. Theſe works are ſometimes made of filled gabions, or faſcines and earth. This term is frequently uſed for any work thrown up to defend the flank of a poſt, or any other place. See FORTIFICATION. It is ſometimes taken for a demi-baſtion, and at other times for a ſquare orillon to cover the cannon of the cazemate.

EPAULETTES, are a kind of ſhoulder-knots; thoſe for the ſoldiers, to be of the colour of the facing, with a narrow yellow or white tape round it, and worſted fringe; thoſe for the officers are made of gold or ſilver lace, with rich fringe. They are badges of diſtinction worn on one or both ſhoulders.

EPROUVETTE, is a machine to prove the ſtrength of gunpowder. They are of different ſorts, according to the fancy of different nations who uſe them. Some raiſe a weight, and others throw a ſhot, to certain heights and diſtances.

EPTAGON. See HEPTAGON.

EQUESTRIAN *ſtatue*, in *military hiſtory*, ſignifies the perſon of any great warrior mounted on horſeback.

EQUESTRIAN *order*, among the Romans, ſignified their knights or equites; as alſo their troopers or horſemen in the field; the firſt of which orders ſtood in contradiſtinction to the ſenators, as the laſt did to the foot: each of theſe diſtinctions was introduced into the ſtate by Romulus.

EQUIPAGE, in a *military ſenſe*, is all kinds of furniture made uſe of by the gentlemen of the army; ſuch as

Camp-EQUIPAGE, } are tents, kitchen-fur-
Field EQUIPAGE, } niture, ſaddle-horſes, baggage-waggons, bat-horſes, &c.

This kind is not determined in our ſervice, neither in regard to quantity or quality; but in the Pruſſian army is as follows, viz.

INFANTRY.

1. The field-marſhal general ſhall take into the field, on chaiſe or coach, with ſix horſes to draw it; 2 baggage waggons; 4 chaiſe-marines, and as many bat-horſes, mules, and ſaddle-horſes, as he pleaſes.

2. A general of foot, 1 chaiſe or coach with 6 horſes; 1 baggage-waggon; 3 chaiſe-marines;

rines; 12 bat-horſes, or mules; and as many ſaddle-horſes as he pleaſes.

3. A lieutenant-general, 1 chaiſe or chariot, with 4 horſes; 1 baggage-waggon; 8 bat-horſes, or mules; and as many ſaddle-horſes as he pleaſes.

4. A major-general, 1 chaiſe with four horſes; 1 baggage-waggon; 1 chaiſe marine; 6 bat-horſes, or mules; and 6 ſaddle-horſes.

5. A colonel, 1 chaiſe with 2 horſes, or 4 at moſt; 2 chaiſe-marines; 6 bat-horſes, or mules; and 4 ſaddle-horſes.

6. A lieutenant-colonel, 1 chaiſe, with 2 horſes; 1 chaiſe-marine; 4 bat-horſes, or mules; and 3 ſaddle-horſes.

7. A major, 1 chaiſe-marine; 4 bat-horſes, or mules; and 3 ſaddle-horſes.

8. A captain is only allowed 1 baggage-waggon for the company, 1 for himſelf, 1 bread-waggon, and 2 ſaddle-horſes.

9. No ſubaltern officer ſhall have a waggon, and is allowed only 1 bat-horſe, and 1 ſaddle-horſe.

N. B. All the chaiſe-marines are coloured alike, and the names of their reſpective regiments painted upon them; as alſo every general's name is painted in like manner upon the baggage-waggons and chaiſe-marines which belong to them.

CAVALRY.

1. A general of the horſe ſhall take into the field, 1 chaiſe or coach, with 6 horſes; 1 baggage-waggon; 3 chaiſe-marines; 12 bat-horſes, or mules; and as many ſaddle-horſes as he pleaſes.

2. A lieutenant-general, 1 chaiſe or chariot, with 4 horſes; 1 baggage-waggon; 2 chaiſe-marines; 8 bat-horſes, or mules; and as many ſaddle-horſes as he pleaſes.

3. A major-general, 1 chaiſe, with 4 horſes; 1 baggage-waggon; 1 chaiſe-marine; 6 bat-horſes, or mules; and 8 ſaddle-horſes.

4. A colonel, 1 chaiſe, with 2 horſes, or at moſt 4; 2 chaiſe-marines; 6 bat-horſes, or mules; and 6 ſaddle-horſes.

5. A lieutenant-colonel, ſhall take 1 chaiſe-marine; 4 bat-horſes, or mules; and 5 ſaddle-horſes.

6. A major, 1 chaiſe-marine; 4 bat-horſes, or mules; and 4 ſaddle-horſes.

7. A captain, 2 chaiſe-marines, 1 for his troop, and the other for himſelf; and 3 or 4 ſaddle-horſes.

8. The ſubaltern officers, 2 ſaddle-horſes, and 1 bat-horſe; but are poſitively not to have waggons; and all ſuch as are provided contrary to this regulation, ſhall be burnt.

N. B. The chaiſe-marines, and baggage-waggons ſhall be painted and coloured as above. The bat-horſes for the infantry, and troop-tents, are excluſive of theſe.

ESCALADE. See SCALADE.

ESCARPE, is the outward ſlope or talus of the rampart.

ESCORT, in the *art of war*. See CONVOY.

ESCOUADE. See SQUADS.

ESPADON, in old *military books*, a kind of two-handed ſword, having two edges, of a great length and breadth; formerly uſed by the Dutch.

ESPLANADE, in *fortification*, the ſloping of the parapet of the covert-way towards the field, and is therefore the ſame as the glacis of the counterſcarp; but begins to be antiquated in that ſenſe, and is now only taken for the empty ſpace between the glacis of a citadel, and the firſt houſes of the town.

ESPONTON. See SPONTOON.

ESPRINGAL, in the *ancient art of war*, a machine for throwing large darts, generally called muchettæ.

ESQUADE. See SQUADS.

ESSES, in the *train of artillery*, are fixed to draught-chains made in the form of an S, one end of which is faſtened to the chain, and the other to hook to the horſe's harneſs, or to a ſtaple: they ſerve likewiſe to lengthen and piece chains together.

ESTOILE. See STAR-REDOUT, STAR-FORT.

ETAPPE, a term uſed in military hiſtory, taken from the French; which ſignifies the quantity of proviſions and forage allowed in an army, in marching through a kingdom, whether going into winter-quarters, or taking the field.

ETAPPIER, in *military hiſtory*, is the perſon that contracts with the country or territory for furniſhing troops in their march with proviſions and forage, &c.

EVACUATE, in *military hiſtory*, a term made uſe of in the articles of capitulation granted to the beſieged at the time they ſurrender to the beſiegers; and is the ſame as quitting a place.

EVOLUTION, in the *art of war*, the motion made by a body of troops, when they are obliged to change their form and diſpoſition, in order to preſerve a poſt, occupy another, to attack an enemy with more advantage, or to be in a condition of defending themſelves the better. That evolution is beſt which, with a given number of men, may be executed in the leaſt ſpace, and conſequently in the leaſt time poſſible.

EVOLUTIONS *of the moderns*, is a change of poſition, which has always for its object either offence or defence. The eſſentials in the performance of an evolution are, order, directneſs, and the greateſt poſſible rapidity. In ſhort, evolutions implies any body of troops marching to charge rapidly, and in good order; totally diſperſing, and forming with the utmoſt readineſs; wheeling in all its divisions; doubling in all ways; or, in other words, forming a column or columns from all points of its front.

EVOLUTIONS *of the ancients*, were their ready marching, wheeling, and forming into every poſition practiſed in thoſe days, &c.

EXAGON. See HEXAGON.

EXECUTION, *Military* EXECUTION, is the pillaging or plundering of a country by the enemy's army.

Military EXECUTION, alſo means every kind of puniſhment inflicted on the army by the ſentence of a court-martial; which is of various kinds, ſuch as tying up to 3 halberts, and receiving a number of laſhes with a whip, compoſed of 9 whip-cord laſhes, and each laſh of 9 knots, from the drummer: or running the gantlope through the parade at guard-mounting, drawn up in 2 lines for that purpoſe; when the provoſt marches through with twigs or ſwitches, and every ſoldier takes as many as there are priſoners to be puniſhed: the priſoner then marches through the 2 lines, and each ſoldier gives him a hard ſtroke, the major riding up and down to ſee that the men lay on properly. When a ſoldier is to be puniſhed with death, a detachment of about 200 men from the regiment he belongs to forms the parade, when a file of grenadiers ſhoots the priſoner to death. N. B. Every nation has different methods of puniſhment.

EXERCISE, in *military affairs*, the practice of all thoſe motions and actions, together with the whole management of arms a ſoldier is to be perfect in, to render him fit for ſervice, and make him underſtand how to attack and defend, as exerciſe is the firſt part of the military art; and the more it is conſidered, the more eſſential it will appear. It frees their bodies from the ruſticity of ſimple nature, and forms men and horſes to all the evolutions of war. Upon it depend the honour, merit, appearance, ſtrength, and ſucceſs of a corps; while we ſee the greateſt armies, for want of being exerciſed, inſtantly diſordered, and that diſorder increaſing in ſpite of command: the confuſion overſets the art of ſkilful maſters, and the valour of the men only ſerves to precipitate the defeat: for which reaſon it is the duty of every officer to take care that the recruits be drilled as ſoon as they join their corps.

The greateſt advantage derived from the exerciſe, is the expertneſs with which men become capable of loading and firing, and their learning an attention to act in conformity with thoſe around them. It has always been lamented, that men have been brought on ſervice, without being informed of the uſes of the different manœuvres they have been practiſing; and that, having no ideas of any thing but the uniformity of the parade, they inſtantly fall into diſorder and confuſion when they loſe the ſtep, or ſee a deviation from the ſtrait lines they have been accuſtomed to at exerciſe. It is a pity to ſee ſo much attention confined to ſhow, and ſo little given to inſtruct the troops in what may be of uſe to them on ſervice. Though the parade is the place to form the characters of ſoldiers, and teach them uniformity, yet being confined to that alone, is too limited and mechanical for a true military genius.

The great loſs that our troops ſuſtained in Germany, America, and the Weſt-Indies, during the laſt war, from ſickneſs, and not from the enemy, was chiefly owing to a neglect of exerciſe. An army, whoſe numbers vaniſh after the firſt 4 months of a campaign, may be very ready to give battle in their exiſting period; but the fact is, that although fighting is one part of a ſoldier's buſineſs, yet bearing fatigue, and being in health, is another, and at leaſt as eſſential as the firſt. A campaign may paſs without a battle; but no part of a campaign can be gone through without fatigue, without marches, without an expoſure to bad weather; all of which have exerciſe for their foundation; and if ſoldiers are untrained to theſe matters, and ſink under them, they are corporeally incapable of rendering much ſervice to their king and country.

It is not from numbers, or from inconſiderate valour, that we are to expect victory; in battle ſhe commonly follows capacity, and a knowledge of arms. We do not ſee that the Romans made uſe of any other means to conquer the world, than a continual practice of military exerciſes, an exact diſcipline in their camps, and a conſtant attention to cultivate the art of war. Hence, both ancients and moderns agree, that there is no other way to form good ſoldiers but by exerciſe and diſcipline; and it is by a continual practice and attention to this, that the Pruſſians have arrived at that point of perfection ſo much admired in their evolutions, and manual exerciſe.

Infantry Exercise, *Manual* Exercise, as appointed by his majeſty, conſiſt in the words of command for that purpoſe. When a regiment is drawn up or paraded for exerciſe, the men are placed 3 deep, either by companies, or divided into platoons, with the grenadiers on the right; and in order to have the manual exerciſe well performed, it is in a particular manner requiſite, that the ranks and files be even, well dreſſed, and the file-leaders well covered: this muſt be very ſtrictly attended to both by the major, and his adjutant: all officers alſo, on ſervice in general, where men are drawn up under arms, or without, muſt be careful that the ranks and files are exactly even; and the ſoldiers muſt learn to dreſs themſelves at once, without the neceſſity of being directed to do it. The beauty of all exerciſe and marching conſiſts in ſeeing a ſoldier carry his arms well, keep his firelock ſteady and even upon his ſhoulder, the right hand hanging down, and the whole body without conſtraint.——The firelocks, when ſhouldered, ſhould be exactly dreſſed in rank and file; the men muſt keep their bodies upright, and in full front, not having one ſhoulder too forward, or the other too backward. The diſtances between the files muſt be equal, and not greater than from arm to arm, which gives the requiſite room for the motions. The ranks are, or ſhould be, 8 feet diſtant from each other. Every motion muſt be done with life, and all facings, wheelings, and marchings, performed with the greateſt exactneſs. Hence a regiment ſhould never be under arms longer than 2 hours. See Manoeuvres, Regiment, Firings.

Cavalry Exercise, is of two ſorts, on horſeback, and on foot. The ſquadrons for exerciſe are ſometimes drawn up 3 deep, though frequently but 2 deep; the talleſt men and horſes in the front, and ſo on. When a regiment is formed in ſquadrons, the diſtance of 24 feet, as a common interval, is always to be left between the ranks; and the files muſt keep boot-top to boot-top. The officers commanding ſquadrons muſt, above all things, be careful to form with great celerity, and, during the whole time of exerciſe, to preſerve their given diſtances. In all wheelings, the flank which wheels, muſt come about in full gallop. The men muſt keep a ſteady ſeat upon their horſes, and have their ſtirrups at a fit length, to make a large and ſure ſtroke with their ſword in time of action.

Artillery Exercise, is the method of teaching the regiments of artillery the uſe and practice of all the various machines of war, viz.

Exercise *of the light field-pieces*, teaches the men to load, ram, and ſponge the guns well; to elevate them, according to the diſtance, by the quadrant and ſcrew; to judge of diſtances and elevations without the quadrant; how to uſe the port-fire, match, and tubes for quick firing; how to fix the drag-ropes, and uſe them in advancing, retreating, and wheeling with the field-pieces; how to fix and unfix the trail of the carriage on the limbers, and how to fix and unfix the boxes for grape-ſhot on the carriages of each piece.

Exercise *of the garriſon and battering artillery*, is to teach the men how to load, ram, and ſpunge; how to handle the hand-ſpikes in elevating and depreſſing the metal to given diſtances, and for ricochet; how to adjuſt the coins, and work the gun to its proper place; and how to point and fire with exactneſs, &c.

Mortar Exercise, is of 2 different ſorts, viz. with powder and ſhells unloaded, and with powder and ſhells loaded; each of which is to teach the men their duty, and to make them handy in uſing the implements for loading, pointing, traverſing, and firing, &c. See Practice.

Howitz Exercise, differs but little from the mortar, excepting its being liable to various elevations; whereas that of the mortar is fixed to an angle of 45°: but the men ſhould be taught the method of ricochet-firing, and how to uſe them for grape-ſhot, &c. See Practice.

Exercises, are alſo underſtood of what young gentlemen or cadets learn in the military academies and riding-ſchools; ſuch as fencing, dancing, riding, the manual exerciſe, &c.

EXPEDITIONS, in a *military ſenſe*, implies quickneſs, applied to time, motion, marching, or attacking an enemy, &c. An expedition is in ſome meaſure like a battle; requires quick reſolves, and rapid execution: it is out of the nature of the thing itſelf to lay down fixed rules for the minute conducting of ſmall expeditions; their firſt principles only can be with certainty fixed, and men will often diſagree about preparations, and differ in their conduct, though they acknowledge the ſame principles.

One of the principles of many ſmall expeditions, is ſurpriſe; and 6 battalions, without much accompanyment, may ſometimes do that which 24, and a great fleet, would not ſucceed in.

There is no part of war ſo intereſting to an inſulary ſoldier as an expedition; nor can there be any part more worthy of attention.

EXPEDITIONS hitherto have had no rules laid down for their conduct, and that part of war has never been reduced to a ſyſtem. The ſlow rules of a great war will not do in expeditions; the ſtroke muſt be ſtruck with ſurpriſe, and affright have dominion before ſuccours come. Debate is out of ſeaſon, and all ſlow proceedings are ruin. Not to advance, is to recede; and not to be on the road to conqueſt, is to be already conquered. There muſt be that glance, which ſees certainly, though inſtantly; that rapidity, which executes on the ſureſt rules, when it ſeems leaſt to act on any.

In all ſmall expeditions, ſuch as expeditions of ſurpriſe, or *coups-de-main*, the favourable ſide of the propoſed action muſt ever be viewed; for if what may happen, what may arrive, what may fall out, is chiefly thought upon, it will, at the very beſt, greatly diſcourage, but in general end in a total failure. Hence the very name of an expedition implies riſk, hazard, precarious warfare, and a critical operation.

An expedition implies five things.

1ſt, A ſecrecy, if poſſible, of preparation, and concealment of deſign, &c.

2dly, That the means bear proportion to the end. In this there will ever be a difference in opinion.

3dly, A knowledge of the ſtate and ſituation of the country, where the ſcene of action is, or the place or object that is to be attacked.

4thly, A commander who has the particular turn of mind, which is moſt adapted to ſuch particular ſort of warfare.

Laſtly, The plan of an expedition, great or ſmall, is ever to be arranged as much as poſſible before ſetting out, and then any appearances that may vary a little from what might have been expected, will not perplex.

EXPERIMENTS, in a *military ſenſe*, are the trials, reſults, or effects, of the applications of any kind of military machines, in order to diſcover their effects or motions, and relations, whereby to aſcertain ſome of their real uſes, or cauſes, &c. See PRACTICE.

EYE-*bolts*. See BOLTS.

F

FAÇADE, in *military fortification*. See FACE.

FACE, in *fortification*, is an appellation given to ſeveral parts of a fortreſs; as the

FACE *of a baſtion*, the two front ſides, reaching from the flanks to the ſalient angle of the baſtion. See FORTIFICATION.

Prolonged FACE, that part of the line of defence razant, which is between the angle of the ſhoulder, and the curtain, or the line of defence razant, diminiſhed by the length of the face of the baſtion. See FORTIFICATION.

FACE *of a place*, is the front comprehended between the flanked angles of two neighbouring baſtions, compoſed of a curtain, two flanks, and two faces; and is ſometimes called the *Tenaille of the place*.

FACE *of a gun*, is the ſuperficies of the metal at the extremities of the muzzle of the piece.

FACE, in *tactics*, a word of command in the manual exerciſe of troops, intimating to turn about: thus,

FACE *to the right*, is to turn upon both heels a quarter-round to the right.

FACE *to the left*, is to turn upon both heels a quarter-round to the left. The ſame takes place with the cavalry, &c.

FAGGOTS, in *military hiſtory*, are men hired to muſter by officers whoſe companies are not complete, to cheat the ſovereign of ſo many men's pay.

FAGGOTS. See FASCINES.

FALCON, or *Faucon*, an ancient name given to a 3-pounder. See CANNON.

FALCONET, an ancient name given to a 1½-pounder. See CANNON.

FALSE *attack*. See ATTACK.

FALSE *alarm*. See ALARM.

FANION, or *Fannon*. See BANNER.

FASCINES, in *fortification*, are a kind of faggots, made of ſmall branches of trees or bruſh-wood, tied in 3, 4, 5 or 6 places, and are of various dimenſions, according to the purpoſes intended. Thoſe that are to be pitched over, for burning lodgments, galleries, or any other works of the enemy, ſhould be 1½ or 2 feet long. Thoſe that are for making epaulements or chandeliers, or to raiſe works, or fill up ditches, are 10 feet long, and 1 or 1¼ feet in diameter. They are made as follows:

ſix ſmall pickets are ſtruck into the ground, 2 and 2, forming little croſſes, well faſtened in the middle with willow bindings. On theſe treſtles the branches are laid, and are bound round with withes at the diſtance of every 2 feet. Six men are employed in making a faſcine; 2 cut the boughs, 2 gather them, and the remaining 2 bind them. Theſe 6 men can make 12 faſcines every hour. Each faſcine requires five pickets to faſten it.

FATHOM, in *fortification*, did originally denote that ſpace a man can reach when both his arms are extended; but now means a meaſure of 6 feet or 2 yards, equivalent to the French word toiſe.

FAUCON. See Falcon.

FAUCONET. See Falconet.

FAUSSE-BRAY, in *fortification*, is a low rampart going quite round the body of the place: their height is about 3 feet above the level ground, and its parapet about 3 or 4 toiſes from that of the body of the place. Theſe works have been entirely rejected by the modern engineers, excepting M. Vauban, who makes them only before the curtains; and then they are called more properly tenailles.

FELLIES, in *artillery*, are the parts of a wheel which form its circumference, whoſe dimenſions are as follow: for a 24-pounder, 5 inches thick, and 6.5 inches broad; for a 12-pounder, 4.5 inches thick, and 6 inches broad; for a 6-pounder, 4 inches thick, and 5.5 inches broad, &c. made of dry elm. There are generally 6 in each wheel. See Wheel.

FENCING, in the *military art*, is that of making a proper uſe of the ſword, as well for attacking an enemy, as for defending one's ſelf. Fencing is a genteel exerciſe, of which no military gentleman ſhould be ignorant. It is learned by practiſing with ſteel foils. See Foils.

Fencing is either ſimple, or compound. Simple is that performed nimbly, and off-hand, on the ſame line. In this the principal intention, in reſpect to the offenſive part, ſhould be to attack the enemy in the moſt unguarded part; and in the defenſive, to parry or ward off the enemy's thruſts or blows.

Guard, in Fencing, implies a poſture proper to defend the body from the ſword of the antagoniſt, and is of various denominations.

Attitude, in Fencing, the head upright, though the body hath a forward inclination on a longe, and all the weight reſting on the left haunch when on guard. The feet, hand, body, arm and ſword, muſt be to the line.

Appels, in Fencing, is a ſudden beat of your blade, on the contrary ſide to that you join your adverſary on, and a quick diſengagement to that ſide again.

Beating, in Fencing, is when you parry with a ſudden ſhort beat, to get a quick repoſt; or when you beat with your foot, to try if you are firm on it, or on both feet.

Battering, in Fencing, is to hit your adverſary's blade on the ſide oppoſite to that you join, &c.

Back-quarte, is a parade of a late invention, and is a round quarte over the arm.

Cave, in Fencing, is a tierce on a quarte ſide, alſo the thruſt of a prime, or a ſecond, at the low quarte ſide.

Darting, in Fencing, to defend a blow with ſome contraction of your arm, and to dart a thruſt right forward.

Faint forward, in Fencing, made by advancing your point a little from its line, and coming to it again.

Guard, in Fencing, is any of the parades you ſtand on.

On guard, is being placed on your feet, and well covered with your weapon.

Hanging guard, is one of the backſword guards, in form of ſecond.

Inſide guard, one of the backſword guards, in form of a quarte.

Lurching, in Fencing, to make an opening, to invite your adverſary to thruſt at you, when you, being ready, may find a favourable repoſt at him.

Locking, in Fencing, is to ſeize your adverſary's ſword arm by twining your left arm round it, after you cloſe your parade, ſhell to ſhell, in order to diſarm him.

Guard in {*carte, tierce, quatre,*} implies the putting of the body and ſword in ſuch a ſtate of defence, as to prevent the antagoniſt from wounding you.

Thruſt in Fencing, the thruſt *in carte*, is to throw your hand as far as you can inſide, with the point of your ſword towards your adverſary's breaſt. *To thruſt ſeconde*, is to have your arm in a perfect oppoſition to your adverſary's, holding your head inſide. *To thruſt tierce*, differs from carte only, by the poſition of the hand, which muſt be reverſed.

Parrying, in Fencing, the action of warding off the blows aimed at each other.

Flanconade, in Fencing, is the action of dropping the point of your ſword under your adverſary's hilt, in ſeizing with force the feeble of his blade; which binding, without quitting it, form the parade in octave, and then throw in your thruſt.

Glizade, in Fencing, is performed by dexterouſly making your ſword ſlip along your adverſary's blade, and forming at the ſame time your extenſion, &c.

FEU *de joie*. See Running-Fire.

FICHANT. See Line of Defence, Fortification.

FIELD-	*Colours*,	See	*Camp-colours*.
	Officers,		*Officers*.
	Pieces,		*Cannon*.
	Staff,		*Lintſtock*.
	Works,		*Field-fortification*.

Field-*marſhal*, a modern military rank in England, but ſuperior to all others; having the chief command of the whole army.

FIGHT. See Battle.

FIGURE, in *fortification*, the plan of any fortified place, or the interior polygon. Of this there are two ſorts, regular, and irregular: a regular figure is that where the ſides and angles are equal; an irregular one is the contrary.

FILE, in the *art of war*, is an unlimited term, comprehending any number of men, drawn up in a direct line behind each other; as a rank, on the other hand, includes any number drawn beſide each other; whether, in either reſpect, they be in cloſe or open order. Or rather, by *file* is meant the line of ſoldiers ſtanding one behind another, which makes the depth of the battalion; and is thus diſtinguiſhed from the rank, which is a line of ſoldiers drawn up ſide by ſide, forming the length of the battalion. A file is 3 deep; hence a battalion or regiment drawn up, conſiſts of 3 ranks, and of as many files as there are men in a rank.

File-*leader*, is the ſoldier placed in the front of any file, or the man who is to cover all thoſe that ſtand directly in the rear of him, and by whom they are to be guided in all their movements. The files of a battalion of foot were formerly 12 and 6 deep; but now only 3, and ſometimes 2 deep. Thoſe of the cavalry are generally but 2 deep.

To double the Files, is to put 2 files into 1, making the depth of the battalion double to what it was, not in the ſpace of ground, but in number of men.

To File *off*, } to wheel off from marching in
To defile, } a ſpacious front and march in length by files. When a regiment is marching in full front, or by diviſions or platoons, and comes to a defile or narrow paſs, it may file off to the right or left as the ground requires, &c.

FIRE, in the *art of war*, a word of command to ſoldiers of all denominations, to diſcharge their fire-arms, grenades, cannon, &c.

Fire-*arms*, are all kinds of arms charged with powder and ball; every one of which is mentioned in their reſpective articles.

Running-Fire, is when a rank or ranks of men, drawn up, fire one after another; or when the lines of an army are drawn out to fire on account of a victory; when each ſquadron or battalion takes it from that on its right, from the right of the firſt line to the left, and from the left to the right of the ſecond line, &c.

Fire-*balls*. See Balls.

Fire-*maſter*, in our royal regiment of artillery, is an officer of rank and dignity, who, beſides the poſt he enjoys in the regiment, has 150l. for his office He gives the directions and proportions of all ingredients for each compoſition required in fire-works, whether for the ſervice of war, or for rejoicings and recreations.

Fire-*maſter's mate*, is always an officer in the royal regiment of artillery, who, beſides the poſt he bears in the regiment, has 80l. a year for this office. His duty is, to aid and aſſiſt the chief fire-maſter, and he ſhould be ſkilled in every kind of laboratory work.

Fire-*pots*, in the *military art*, ſmall earthen pots, into which is put a charged grenade, and over that, powder enough to cover the grenade; the whole covered with a piece of parchment, and two pieces of quick-match acroſs lighted: it breaks and fires the powder, as alſo the powder in the grenade, which has no ſuze, that its operations may be quicker: it burns all that is near it.

Fire-*works*, are particular compoſitions of different ſorts, made with ſulphur, ſalt-petre, and charcoal. They are uſed in war, and on rejoicing-days.

Fire-*workers*, were formerly ſubordinate to the fire-maſter and his mate; had afterwards the rank of youngeſt lieutenants to the royal regiment of artillery; but now that rank is aboliſhed, and they are all ſecond lieutenants. They were ſuppoſed to be well ſkilled in every kind of laboratory-work, which knowledge is an eſſential qualification in every officer of that regiment.

Fire-*locks*, ſo called from their producing fire of themſelves, by the action of the flint and ſteel; the arms carried by a foot-ſoldier: they are 3 feet 8 inches in the barrel, and with the ſtock 4 feet 8 inches; and carry a leaden bullet of which 29 make 2 lb. its diameter is .550 of an inch, and that of the barrel 1-50th part of the ſhot. Fire-locks were firſt made uſe of in 1690, when match-locks were univerſally diſuſed; but when invented, we cannot aſcertain. A firelock is called, by writers of about the middle of the laſt century, *aſnaphaan*, which being a Low-dutch word, ſeems to indicate its being a Dutch invention.

FIRINGS, in the *military art*, are of various ſorts and denominations. At preſent we have no leſs than 8 or 9 different methods of firing in battalion; and as they cannot be all good, ſome one of them muſt be the beſt, both in regard to offenſive and defenſive firings; and if ſo, the others muſt in courſe be inferior to this. The object of firing is to do the moſt execution to the enemy: hence there muſt be ſome method of firing in battalion, and againſt battalion, more effectual than, and if ſo, preferable to the others. Let us attempt in ſome meaſure to determine which of theſe methods is the beſt. The preſent method of firing by platoons, cannot, we imagine, be the moſt effectual fire poſſible; becauſe there are ſo many platoons to fire after each other, that the men muſt always load much faſter than they are called on to fire: ſo that we have continually obſerved one of theſe platoons, after firing, to load again, and then remain ſo while one might with moderate quickneſs count from 180 to 260, i.e. about 3½ minutes before it becomes its turn to fire again. This is totally inconſiſtent with, and contradictory to, every one's ideas of a proper fire. The reaſon generally given for firing by platoons, is that a conſtant and perpetual fire ſhall always be kept up. How ever true this reaſon may be, we apprehend it will neither require nor defend the preſent method of platoon-firing; ſince a more numerous and effectual fire may be made, and alſo kept up ſo as to be perpetual. In the Pruſſian army, the men are taught to load with the utmoſt quickneſs; and we are well aſſured that they are more expeditious, both in loading and firing, than moſt other armies are; which perhaps one may be the more ready to conceive, from obſerving with how much greater expedition ſome of our own regiments perform than others.

Platoon-Firing, conſiſts in three different methods, viz. ſtanding, advancing, and retreating. Preparative to every kind of firing, each regiment or battalion muſt be told off in grand-diviſions, ſub-diviſions, and platoons; excluſive of the grenadiers, which form 2 ſub-diviſions or 4 platoons of themſelves. In firing ſtanding, whether by diviſions or platoons, the firſt fire is from the diviſion or platoon on the right; the ſecond fire, from the left; the third fire, from the right again; and ſo on alternatively until the firing comes to the centre platoon, which is generally called the colour platoon, and does not fire, remaining as a reſerve for the colours.

The platoon-firing is ſuch as muſt neceſſarily produce a general confuſion, as well by the noiſe of thoſe who command, as by the breaking of the line, and kneeling, which are three of the greateſt inconveniences that can happen; and it cannot be executed without imminent danger, when near the enemy. Even the king of Pruſſia himſelf is of the ſame opinion; for he ſays, "the platoon fire would, no "doubt, be the beſt, if it could be executed."

Firing *advancing*, is performed in the ſame manner as when ſtanding, with this addition, that before either diviſion or platoon fires, it advances 3 paces forwards; and ſo of the reſt.

Firing *retreating*, varies greatly from either of the former methods; for before either a diviſion or platoon fires (ſuppoſing they are marching from the enemy) it muſt go to the right about, and after firing, to the left about again, and continue the retreat as ſlow and orderly as poſſible.

Hedge-Firing, is only applicable when troops happen to be drawn up oppoſite to one another, and behind parallel fences, ſuch as low walls, banks, hedges, &c. by the intervention of which they cannot approach nearer to each other. In this kind of firing, the men are to be drawn up 2 deep, which will of courſe either make their ranks more extenſive, or will procure them a reſerve; and in that order both ranks are to fire ſtanding.

Parapet-Firing, like hedge-firing, cannot be introduced conveniently at the time of common exerciſe. This arrangement is one of thoſe operations which are only intended for defence; and the method requiſite for that diſpoſition depends as well upon the nature of the parapet over which the men are to fire, as upon that of the attack made to poſſeſs it. Hence, this method of firing is ſometimes performed by ſingle ranks ſtepping upon the banquette, and firing; each man inſtantly handing his arms to the centre rank of the ſame file, and taking his back in the room of it; and then he of the centre rank gives it to him in the rear to load, and takes back his in return, ready to give to him in the front rank; by which means the front-rank man can fire 6 or 7 rounds in a minute with exactneſs. Parapet-firing may alſo be executed 2 deep, in a fortification, where the banquette is 3 feet broad, or in field-works where no banquettes are made. In ſhort, were thoſe who are to defend, but to underſtand their own advantage, and to act with temper on every occaſion, they would find themſelves able to baffle almoſt any attack that ſhould be made againſt them.

Oblique-Firing, is either to the right and left, or from the right and left to the centre, depending entirely on the ſituation of the object to be fired againſt. The Pruſſians have a particular contrivance for this purpoſe: if they are to level to the right, the rear ranks of every platoon are to make two quick but ſmall paces to the left, and the body of each ſoldier to turn 1-8th of a circle; and they are to take the ſame diſtance to the right, if they are to level to the left. Perhaps if one was to wheel out the diviſions or platoons of a battalion 1-6th or 1-8th of a circle, it would render their fire direct, though the object be extremely oblique.

Street-Firing, is made uſe of when two bodies of men meet in a ſtreet, road, defile, or any ſuch like ſituation, where both are equally alike incloſed in ſuch paſs, and neither of them can attack the other's flank. In our preſent diſcipline we practiſe two methods of ſtreet-firing; the one is, by making the diviſion or platoon that has fired, to wheel afterwards by half-rank to the right and left outwards from the centre, and to march in that order by half-diviſions down the flanks on each ſide of the column, and to draw up in the rear, and go on with their priming and loading. The other method is, to make the diviſion or platoon, after firing, to face to the right and left outwards from the centre, and one half-rank to follow the other; and in that order to march in one centre file down on each ſide of the column into the rear, and there draw up as before.

Now, by the firſt method, you muſt have a front double the extent of your rank, otherwiſe, the diviſion that fires cannot wheel out, and march into the rear: conſequently the enemy will have an advantage of a front double in extent to yours; which will enable him not only to return your attack with a front of equal force, but to attack you at the ſame time on each flank with a quarter force more, beſides the further advantage he gets by the time you ſpend in wheeling to clear your front for the ſucceeding diviſion to come up and fire.

And as to the other method, though you increaſe by the extent of your ranks, and conſequently the weight of your fire; yet, what is thus gained in front, is more than loſt in time, by the ſtill more tedious form of making the ranks to face to the right and left outwards, and to follow each other into the rear, which gives an opportunity that a ſagacious ſpirited enemy will not fail to improve, and take advantage of to your total deſtruction.

Inſtead of the above methods, we ſhould prefer the column formed of ranks; becauſe, at moſt, roads, ſtreets, &c. are ſeldom of equal breadth in all parts. This column can, from its conſtruction, eaſily contract itſelf by doubling its ranks, and again unfold itſelf to its former breadth, as occaſion requires, which operation a column of files cannot effect; and, inſtead of firing, only make uſe of the bayonet, and decide the affair by manly vigour. The advantages of this method are theſe: 1ſt, the enemy cannot get in upon either of your flanks, to diſorder you; and, 2dly, as the enemy will be ignorant of your deſign to reſerve your fire, and ſolely to depend upon your bayonet, he will moſt probably give his fire on your advancing, which as ſure as he does, he is inevitably loſt.

Square-Firing, is that method of firing where either a regiment or any body of men are drawn up in a hollow ſquare, each front of which is generally divided into 4 diviſions or firings, and the flanks of the ſquare, as being the weakeſt part, are covered by 4 platoons of grenadiers. The firſt fire is from the right diviſion of each face; the ſecond fire from the left diviſion of each face, and ſo on; the grenadiers making the laſt fire.

Running-Fire, when men, drawn up for that purpoſe, fire one after another, as faſt as poſſible, ſo that it runs the whole length of the line, &c. It is uſed upon all public rejoicings.

Firing *by a new method propoſed*. Having ventured to mention our objections to the preſent methods of firing, we will now take the liberty to propoſe an entire new ſcheme of firing. As the grenadier company of every battalion is frequently detached from it, at leaſt in its firings, we will therefore ſay that the battalion, with which we are going to perform this new method of firing, conſiſts of 8 companies; and as we imagine that 4 good ſoldiers ſhould keep up a quick and conſtant fire, ſo we conceive that 4 good diviſions ſhould do ſo; and thence propoſe, that the battalion ſhall fire at 4 times. However, for reaſons given, we do not mean to fire by grand diviſions, but to divide each of thoſe grand diviſions into 4 platoons; and that one platoon from each grand diviſion ſhall fire at the ſame time, or as nearly ſo as may be practicable. Thus 4 platoons being equal to 1 grand diviſion, would, in effect, fire at once, but from different parts of the battalion; and the whole battalion, divided into 16 platoons, would fire at 4 times: by which method a perpetual fire will be kept up, and managed with much more eaſe and regularity than the preſent method. The Swedes were the firſt who practiſed firing by 2 or 3 ranks at a time, and that ſo early as 1620. Platoon-firing is the invention of the famous Guſtavus Adolphus, and firſt uſed about the year 1618: we alſo find that Lewis XIV, in 1662, employed M. Martinet to regulate and diſcipline his infantry after the Dutch manner, which was then in great eſteem under prince Maurice, of Naſſau, who had learned it from the king of Sweden.

FLAGS. See Colours, Standards, &c.

FLANKS, in the *art of war and fortifications*, are of ſeveral denominations, according to their uſes, viz.

Flanks *of an army*, are the troops encamped on the right and left of each line of encampment.

Flank *of a baſtion*, in *fortification*, that part which joins the face to the curtain, comprehended between the angle of the curtain and that of the ſhoulder, and is the principal defence of the place. Its uſe is, to defend the curtain, the flank, and face of the oppoſite baſtion, as well as the paſſage of the ditch; and to batter the ſalient angles of the counterſcarp and glacis, from whence the beſieged generally ruin the flanks with their artillery; for the flanks of a fortification are thoſe parts which the beſiegers endeavour moſt to ruin, in order to take away the defence of the face of the oppoſite baſtion.

Oblique }
Second } Flank, { that part of the curtain from whence the face of the oppoſite baſtion may be diſcovered, and is the diſtance between the lines razant and fichant, which are rejected by moſt engineers, as being liable to be ruined at the beginning of a ſiege, eſpecially when made of ſandy earth. The ſecond parapet, which may be raiſed behind the former, is of no uſe; for it neither diſcovers nor defends the face of the oppoſite baſtion: beſides, it ſhortens the flank, which is the true defence; and the continual fire of the beſiegers cannon will never ſuffer them to raiſe a ſecond parapet. This ſecond flank defends very obliquely the oppoſite face, and is to be uſed only in a place attacked by an army without artillery.

Retired }
Low } Flank, { the platform of the cazematte, which lies hid in
Covered } the baſtion. Theſe retired flanks are a great defence to the oppoſite baſtion and paſſage of the ditch; becauſe the beſiegers cannot ſee, nor eaſily diſmount their guns.

Flanked *angle*, in *fortification*, that formed by the 2 faces of a baſtion, or its ſalient angle.

Flanking *angle*, in *fortification*, that compoſed of the two lines of defence, and pointing towards the curtain. See Tenaille.

Flanking *line of defence*. See *Line of defence*.

Flank *prolonged*, in *fortification*, is the extending of the flank from the angle of the epaule to the exterior ſide, when the angle of the flank is a right one.

To Flank, in the *art of war*, is to diſcover and fire upon the ſide or flank of an enemy. Any fortification, which has no defence but right forward, is faulty; and to make it complete, one part ought to flank the other.

Concave Flank, is that which is made in the arc of a circle.

Flanking, is the ſame in *fortification* as defending.

Flank, in *general*, is any part of a work that defends another work, along the outſide of its parapet.

FLASK, in *ancient military hiſtory*, a meaſure made of horn, formerly uſed to carry powder in, with the meaſure of the charge of the piece on the top of it.

FLAT-*bottomed boats*, in *military affairs*, are made to ſwim in ſhallow water, and to carry a great number of troops, artillery, ammunition, &c. They are conſtructed in the following manner: a 12-pounder, bow chaſe, an 18 ditto, ſtern chaſe; 90 to 100 feet keel; 12 to 24 ditto beam; one maſt; a large ſquare mainſail; a jibb-ſail: they are rowed by 18 or 20 oars, and can each carry 400 men. The gun takes up one bow, and a bridge the other, over which the troops are to march. Thoſe that carry horſes have the fore parts of the boats made to open, when they are to mount and ride over a bridge.

FLATTER-*mine*. See Mine.

FLECHE, in *field fortification*, a work of two faces, uſually raiſed in the field, to cover the quarter guards of a camp or advanced poſts.

FLINTS, in *military affairs*, are well known ſtones, uſed at preſent with all ſorts of firearms. Every ſoldier ought always to have 1 or 2 ſpare flints in war-time.

FLYING - { *army*. See Army.
{ *bridge*. See Bridge.

Flying-*camp*. See Camp.

FOCUS, in *mining*. See Mine.

FODDER. See Forage.

FOIL, in *fencing*, a blunt ſword, uſed to learn to fence with; it is without a point, or any ſharpneſs, having a button at the extremity, covered with leather.

FOOT, in a *military ſenſe*, ſignifies all thoſe bodies of men that ſerve on foot. See Infantry.

Foot, is alſo a long meaſure, conſiſting of 12 inches. Geometricians divide the foot into 10 digits, and the digits into 10 lines; but we divide the foot into 12 inches, and an inch into 12 lines, and a line into 12 points.

A ſquare Foot, is the ſame meaſure, both in length and breadth, containing 12×12=144 ſquare or ſuperficial inches.

A cubic FOOT, is the ſame meaſure in all the 3 dimenſions, length, breadth, and thickneſs; containing 12 × 12 = 144 × 12 = 1728 cubic inches. The foot is of different length in different countries. The Paris royal foot exceeds the Engliſh by 9 lines; the ancient Roman foot of the capital, conſiſted of 4 palms = 11$\frac{4}{10}$ Engliſh inches; and the Rhineland or Leyden foot, by which the northen nations go, is to the Roman foot as 950 to 1000. The proportions of the principal feet of ſeveral nations are as follow. The Engliſh foot being divided into 1000 parts, or into 12 inches, the other feet will be as follow:

PLACES.	1000 parts	feet	inch.	lines
London foot - -	1000	—	12	—
Amſterdam - -	942	—	11	3
Antwerp - - -	946	—	11	2
Bologna - - -	1204	1	2	4
Berlin - - -	1010	1	—	2
Bremen - - -	964	—	11	6
Cologne - - -	954	—	11	4
Copenhagen - -	965	—	11	6
Dantzig - - -	944	—	11	3
Dort - - -	1184	1	2	2
Frankfort on the main	948	—	11	4
The Greek - -	1007	1	—	1
Mantua - - -	1569	1	6	8
Mechlin - - -	999	—	11	—
Middlebourg - -	991	—	11	9
Paris Royal - -	1068	1	—	9
Prague - - -	1026	1	—	3
Rhineland - -	1033	1	—	4
Riga - - -	1831	1	9	9
Roman - - -	967	—	11	6
Old Roman - -	970	—	11	8
Scotch - - -	1005	1	—	$\frac{5}{7}$
Straſbourg - -	920	—	11	—
Madrid - - -	899	—	10	7
Liſbon - - -	1060	1	—	6
Turin - - -	1062	1	—	7
Venice - - -	1162	1	1	9

To be on the SAME FOOT *with another,* is to be under the ſame circumſtances in point of ſervice; to have the ſame number of men, and the ſame pay, &c.

To gain or loſe ground FOOT *by* FOOT, is to do it regularly and reſolutely; defending every thing to the utmoſt extremity, or forcing it by dint of art or labour.

FOOT-*bank*, in *fortification*. See BANQUETTE.

FORAGE, in the *art of war,* implies hay, ſtraw, and oats, for the ſubſiſtence of the army horſes. This forage is divided into rations, one of which is a day's allowance for a horſe, and contains 20lb. of hay, 10lb. of oats, and 5lb. of ſtraw.

FOREIGN *ſervice,* in *military matters,* means every ſervice but our own.

FORELAND, in *fortification.* See BERM.

FORGE, in the *train of artillery,* is generally called a *travelling-forge,* and may not be improperly called a portable ſmith's ſhop: at this forge all manner of ſmith's work is made, and it can be uſed upon a march, as well as in camp. Formerly they were very ill contrived, with 2 wheels only, and wooden ſupporters to prop the forge for working when in the park. Of late years they are made with 4 wheels, which anſwers their purpoſe much better.

Dimenſions of a travelling-FORGE.

		Inches.
Fore wheels, height		104
Nave, length		14
Diameters - -	body	12
	middle	13
	linch	9
Fellies - - -	height	4
	breadth	3
Spokes - - -	breadth	1.7
	thickneſs	3
Hind wheels, height		64
Nave, length		14
Diameters - -	body	12
	middle	13
	linch	9
Fellies - - -	height	4
	breadth	3
Spokes - - -	breadth	1.7
	thickneſs	3
Fore axle-tree, total length		76
Hind axle-tree, total length		76
Body - - -	length	42
	breadth	6
	height	7
Arms, length		17
Diameters - -	body	5
	linch	3
Shafts with ſides, total length		20.3
Breadth - -	behind	4
	middle	4.5
	before	2.8
Height - - -	behind	3
	before	2
	middle	2.8
Opening - -	before	25
	middle	35
	behind	30
Naves - - -	length	14
	breadth	3
	height	6

Uprights

Uprights - -	length	27
	breadth	3
	thickneſs	2.2
Fore croſs-bar -	breadth	3
	thickneſs	2.2
Hind croſs-bar	breadth	2
	thickneſs	2.2
From the fore end to the axle-tree		23
From the hind end to the axle-tree		14
Diſtance between		74

Forge *for red-hot balls*, is a place where the balls are made red-hot before they are fired off: it is built about 5 or 6 feet below the ſurface of the ground, of ſtrong brick-work, and an iron grate, upon which the balls are laid, with a very large fire under them. See Red-hot Balls.

FORLORN-*hope*, in the *military art*, ſignifies men detached from ſeveral regiments, or otherwiſe appointed to make the firſt attack in the day of battle; or at a ſiege, to ſtorm the counterſcarp, mount the breach, &c. They are ſo called from the great danger they are unavoidably expoſed to; but the expreſſion is old, and begins to be obſolete.

FORMS, FORMERS, in *gunnery*, are round pieces of wood, fitted to the bore of every gun's diameter, on which the paper, parchment or flannel, which is to make the cartridges, are rolled before they are paſted or ſewed.

FORMING *the line*, in the *military art*, drawing up infantry, cavalry, and artillery, into a line of battle, &c.

FORRAGE. See Forage.

FORT, in the *military art*, a ſmall fortified place, environed on all ſides with a ditch, rampart, and parapet. Its uſe is to ſecure ſome high ground, or the paſſage of a river, or to make good an advantageous poſt, to defend the lines and quarters of a ſiege, &c.

Forts are made of different figures and extents, according as the ground requires, or the ſervice intended. Some are fortified with baſtions, others with demi-baſtions. Some are in form of a ſquare, others of a pentagon. Some again are made in the form of a ſtar, having 5 or 7 angles. A fort differs from a citadel, as this laſt is built to command ſome town. See Citadel.

Royal-Fort, one whoſe line of defence is at leaſt 26 toiſes long.

To fortify a ſquare Fort, according to the uſual method. Having inſcribed the ſquare in a circle (Plate X. fig. 1.) 1. Divide each of its ſides *AB*, *BD*, &c. into two equal parts, in the point *F*. 2. From the centre *E*, draw an indefinite line *EF*. 3. From the centre draw alſo the lines *EA*, *EB*, *ED*, *EC*, to the angles of the ſquare. 4. Divide the ſide *AB* into eight equal parts. 5. Let one of theſe parts be ſet off from *F* to *G*, and from *G* draw the lines of defence *AG*, *BG*. 6. Divide another ſide of the ſquare into 7 equal parts. 7. Set off two of theſe parts from *A* to *K*, and from *B* to *L*, which will be the faces of the baſtions. 8. Take the diſtance *KL* in your compaſſes, and ſet it off on the lines of defence from *K* to *H*, and from *L* to *I*; and draw *HI*, which will be the curtain; and the lines *KI*, *LH*, will be the flanks.

To fortify a ſquare fort in the moſt modern manner. Give the ſide *AA* (Plate X. fig. 3.) 130 fathoms; the demi-gorges *AB*, 25 fathoms; and with the compaſſes opened to the length of the pricked line *BCB*, which is the diagonal of two ſides, from each of which there has been taken 25 fathoms, upon the extremity oppoſed to the angle which they form, deſcribe two arches above the angle of the figure, alternatively making uſe of the points *B* for centres; then draw lines from the points of interſection of the arches *D*, to the point which ſerved for centres *B*, upon which points *B*, raiſe the flanks *BE*, perpendicular to the oppoſed lines of defence *BD*.

Star-Fort, a redout formed by a number of re-entering, and ſalient angles, the ſides of which flank each other. See Plate X. fig. 2.

To deſcribe a ſtar-fort. 1. Draw an hexagon *aBCdef*. 2. Divide one of its ſides *BC* into 4 equal parts. 3. Upon the centre of this ſide, raiſe the perpendicular *DA*, equal to 1-4th of the ſide *BC*, from *D* to *A*. 4. From the point *A*, draw the faces *AC*, *AB*. Let the ſame operations be performed with reſpect to the other ſides of the hexagon, and you will have the ſtar-fort required.

Triangular Forts, are frequently made with half-baſtions; but very imperfect, becauſe the faces are not ſeen or defended from any other part. If, inſtead of being terminated at the angle, they were directed to a point about 20 toiſes from it, they would be much better, as being then defended by that length of the rampart, though but very obliquely. The ditch ought to be from 8 to 10 toiſes. See Plate X. fig. 4. Sometimes they are made as in Plate X. fig. 5. that is, triangular as before; but inſtead of half-baſtions at the angles, whole ones are placed in the middle of the ſides. The gorges of theſe baſtions may be from 20 to 24 toiſes, when the ſides are from 100 to 120; the flanks are perpendicular to the ſides, from 10 to 12 toiſes long; and the capitals from 20 to 24. If the ſides happen to be more or leſs, the parts of the baſtions are likewiſe made more or leſs in proportion. The ditch round this fort may be 10 or 12 toiſes wide.

The ramparts and parapets of theſe ſorts of works are commonly made of turf, and the outſide of the parapet fraiſed; that is, a row of palliſades are placed about the middle of the ſlope, in an horizontal manner, the points declining rather a little downwards, that the grenades or fireworks thrown upon them may roll down into the ditch; and if the ditch is dry, a row of palliſades ſhould be placed in the middle of it, to prevent the enemy from paſſing over it unperceived, and to ſecure the fort from any ſurpriſe.

FORTIFICATION, in the *military art*, is the art of fortifying a town, or other place; or of putting it in ſuch a poſture of defence, that every one of its parts defends, and is defended by ſome other parts, by means of ramparts, parapets, ditches, and other outworks; to the end that a ſmall number of men within may be able to defend themſelves for a conſiderable time againſt the aſſaults of a numerous army without; ſo that the enemy, in attacking them, muſt of neceſſity ſuffer great loſs. See Plate XI. fig. 1.

Fortification may be divided into ancient and modern; offenſive, and defenſive; regular, and irregular; natural, and artificial, &c.

Ancient FORTIFICATION, at firſt, conſiſted of walls or defences made of trunks, and other branches of trees, mixed with earth, for ſecurity againſt the attacks of an enemy. Invention owes its original to neceſſity; *fortification* ſeems to have had fear for its father; for when man had no other enemy but the wild beaſts, the walls of his cottage were his ſecurity; but when pride, ambition, and avarice, had poſſeſſed the minds of the ſtrong and the daring to commit violences upon their weaker neighbours, either to ſubject them to new laws, or to ſpoil their little inheritance, it was natural for the latter to contrive how to defend themſelves from ſuch injuries.

Whoever has been in North-America, may have ſeen *fortification* in its infancy.

There are abundance of Indian villages fenced round by long ſtakes drove into the ground, with moſs or earth to fill the intervals; and this is their ſecurity (together with their own vigilance) againſt the cruelty of their ſavage neighbouring nations.

Nor is *fortification* much leſs ancient than mankind; for Cain, the ſon of Adam, built a city with a wall round it upon mount Liban, and called it after the name of his ſon Enoch, the ruins of which, it is ſaid, are to be ſeen to this day; and the Babylonians, ſoon after the deluge, built cities and encompaſſed them with ſtrong walls.

At firſt people thought themſelves ſafe enough with a ſingle wall, behind which they made uſe of their darts and arrows with ſafety; but as other warlike inſtruments were continually invented to deſtroy theſe feeble ſtructures, ſo on the other hand the defendants were obliged to build ſtronger and ſtronger, to reſiſt the new contrived forces of the deſperate aſſailers.

What improvements they made in ſtrengthening their walls many ages ago, appear from hiſtory. The firſt walls we ever read of, and which were built by Cain, were of brick; and the ancient Grecians, long before Rome was ever thought of, uſed brick and rubble-ſtone, with which they built a vaſt wall, joining mount Hymetus to the city of Athens. The Babylonian walls, built by Semiramis, or, as others will have it, by Belus, were 32 feet thick, and 100 feet high, with towers 10 feet higher, built upon them, cemented with bitumen or aſphaltus. Thoſe of Jeruſalem ſeem to have come but little ſhort of them, ſince, in the ſiege by Titus, all the Roman battering-rams, joined with Roman art and courage, could remove but 4 ſtones out of the tower of Antonia in a whole night's aſſault.

When *fortification* was at this height, it ſtopped for many ages, 'till the uſe of gunpowder and guns was found out; and then the round and ſquare towers, which were very good flanks againſt bows and arrows, became but indifferent ones againſt the violence of cannon; nor were the battlements longer a hiding-place, when the force of one ſhot both overſet the battlement, and deſtroyed thoſe who ſought their ſecurity from it.

Modern FORTIFICATION, is the way of defence now uſed, turning the walls into ramparts, and ſquare and round towers into baſtions, defended by numerous outworks; all which are made ſo ſolid, that they cannot be beat down, but by the continual fire of ſeveral batteries of cannon. Theſe baſtions at firſt were but ſmall, their gorges narrow, their flanks and faces ſhort, and at a great diſtance from each other, as are thoſe now to be ſeen in the city of Antwerp, built in 1540 by Charles V. emperor of Germany; ſince which time they have been greatly improved and enlarged, and are now arrived to that degree of ſtrength, that it is almoſt a received opinion, that the art of fortification is at its height, and almoſt incapable of being carried to a much greater perfection. See Plate XI. fig. 1.

Offenſive FORTIFICATION, ſhews how to beſiege and take a fortified place; it further teaches a general how to take all advantages for his troops; the manner of encamping, and method of carrying on either a regular or irregular ſiege, according as circumſtances may direct.

Defenſive FORTIFICATION, ſhews a governor how to make the beſt of a garriſon committed to his care, and to provide all things neceſſary for its defence.

Regular FORTIFICATION, is that built in a regular polygon, the ſides and angles of which are all equal, being commonly a muſket-ſhot from each other, and fortified according to the rules of art.

Irregular FORTIFICATION, on the contrary, is that where the ſides and angles are not uniform, equi-diſtant, or equal; which is owing to the irregularity of the ground, vallies, rivers, hills, and the like.

To FORTIFY *inwards*, is to repreſent the baſtion within the polygon propoſed to be fortified; and then that polygon is called the *exterior polygon*, and each of its ſides the *exterior ſide*, terminating at the points of the two neareſt baſtions.

To FORTIFY *outwards*, is to repreſent the baſtion without the polygon propoſed to be fortified, and then the polygon is called the *interior polygon*, and each of its ſides the *interior ſide*, terminating in the centres of the two neareſt baſtions.

Elementary FORTIFICATION, by ſome likewiſe called the theory of fortification, conſiſts in tracing the plans and profiles of a fortification on paper, with ſcales and compaſſes; and examining the ſyſtems propoſed by different authors, in order to diſcover their advantages and diſadvantages. The elementary part is likewiſe divided into regular and irregular fortification, which ſee.

Practical FORTIFICATION, conſiſts in forming a project of a fortification, according to the nature of the ground, and other neceſſary circumſtances, to trace it on the ground, and to execute the project, together with all the military buildings, ſuch as magazines, ſtore-houſes, barracks, bridges, &c.

The names of every part of a FORTIFICATION, and firſt of lines, which are divided into right lines, and curve lines.

Line of defence, is the diſtance between the ſalient angle of the baſtion, and the oppoſite flank; that is, it is the face produced to the flank. Common experience, together with ſome of the greateſt artiſts in fortification, unanimouſly agree, that the *lines of defence* may extend (though not exceed) 150 fathom. Some indeed will affirm that, a muſket carrying no more than 130 fathom point-blank, the angle of the baſtion ſhould be no further removed from its oppoſite flank. I agree that a muſket carries no farther point-blank; but I am ſure it will do execution, and kill, at 180 fathom. The enemy generally make their breaches near the middle of the face; which if granted, the line of fire from the flank to the breach, ſcarce exceeds 130 fathom; beſides, the cannon of the flank do leſs execution upon a ſhort *line of defence* than on a long one.

Line of defence fichant, is a line drawn from the angle of the curtain, to the point of the oppoſite baſtion, which is not to exceed 120 fathom; and from the point of the curtain, and flank, the face of the oppoſite baſtion is to be defended. This line may not improperly be called in good Engliſh the *butting-flank*, ſince it partly ſees the oppoſite faces in reverſe; and the ſhot from it, eſpecially near the orillon, ſtrike againſt the faces. The authors are numerous both for and againſt the *fichant* and *razant* lines; thence we ſhall only add, that the more powerful the active quality is, the more the paſſive muſt ſuffer; that in fortification the active quality is the fire, which diſcovers the aſſailants (who are the paſſive) going to attack the face of the oppoſite baſtion; and by conſequence, the more this active quality is augmented, by ſo much more the paſſive ſubjects muſt ſuffer: and from thence we argue for the *fichant flank*, ſince it augments this active quality, by all the fire of the curtain added to the flank, which is the principal action in the art of defence.

Line of defence razant, is a line drawn from the point of the baſtion along the face, 'till it comes to the curtain, which ſhews how much of the curtain will clear or defend the face. This line may very juſtly in our language be called the *ſweeping-flank*; becauſe the ſhot as it were ſweeps along the oppoſite faces. This line, as well as the *fichant*, has many defendants, and as many opponents; thence, we will only obſerve, that in our humble opinions the *line fichant* is preferable to the *line razant*.

Line of circumvallation. See SIEGE. See CIRCUMVALLATION.

Line of countervallation. See SIEGE. See COUNTERVALLATION.

Line of counter-approach. See SIEGE. See APPROACHES.

Capital-line, is an imaginary line which divides the work into two equal and ſimilar parts, or a line drawn from the point of the baſtion to the point where the two demi-gorges meet, &c.

Line of defence prolonged. In the ſquare, and moſt polygons of the leſſer fortification, you prolong the line of defence; but in the polygons of the greater and meaner, you draw a line from the angle of the oppoſite ſhoulder to the angle of the curtain, upon which you raiſe a perpendicular, which ſerves for the firſt line of the flank.

Names of the angles in a FORTIFICATION.

Angle of the centre, in a polygon, is formed by two radii drawn to the extremities of the ſame ſide, or from the centre, terminating at the two neareſt angles of the figure.

Angle of a baſtion,
Flanked angle, } that which is made by the two faces, being the utmoſt part of the baſtion, moſt expoſed to the enemy's batteries, frequently called the ſalient angle, or point of the baſtion.

Angle of the polygon, is made by the concourſe of 2 adjacent ſides of a polygon, in the centre of the baſtion.

Angle of the	*triangle,*	is half the angle of the polygon.
	ſhoulder, *epaule,*	is made by the face and flank of the baſtion.
	flank, *curtain,*	that which is made by, and contained between the curtain and the flank.

Angle of the tenaille,
Flanking-angle, } made by 2 lines fichant, that is, the faces of the 2 baſtions extended 'till they meet in an angle towards the curtain, and is that which always carries its point towards the work.

Dead-angle.
Rentrant-angle. } All angles are ſo called, that point inwards, or are not well defended.

Angle of the ditch, is formed before the centre of the curtain, by the outward line of the ditch.

Re-entering angle, is any angle whoſe point turns inwards, or towards the place; that is, whoſe legs open towards the field.

Salient angle, is that which points outwards, or whoſe legs open towards the place.

Angle of the complement of the line of defence, is the angle formed by the interſection of the 2 complements with each other.

Inward flanking angle, that which is made by the flanking-line, and the curtain. See ANGLE.

Names of the ſolid works of a FORTIFICATION.

Area, the ſuperficial content of a rampart, or other work.

Arrow, is a work placed at the ſalient angle of the glacis, and conſiſts of 2 parapets, each about 40 fathom long: this work has a communication with the covert-way, of about 24 or 28 feet broad, called a caponier, with a ditch before it of about 5 or 6 fathom, and a traverſe at the entrance, of 3 fathom thick, and a paſſage of 6 or 8 feet round it.

Appareille, is that ſlope or eaſy aſcent leading to the platform of the baſtion, or to any other work where the artillery, &c. are brought up and down.

Advance-foſs,
Avant-foſſe, } or ditch made at the foot of the glacis: it is but very ſeldom made, becauſe it is eaſily taken, and ſerves for a trench to the beſiegers.

Banquette, whether ſingle or double, is a kind of ſtep made on the rampart of a work near the parapet, for the troops to ſtand upon, in order to fire over the parapet: it is generally 3 feet high when double, and 1½ when ſingle, and about 3 feet broad, and 4½ feet lower than the parapet.

Berm, is a little ſpace, or path, of 6 or 8 feet broad, between the ditch and the talus of the parapet; it is to prevent the earth from rolling into the ditch, and ſerves likewiſe to paſs and repaſs. As it is in ſome degree advantageous to the enemy, in getting footing, moſt of the modern engineers reject it.

Baſtion, is a part of the inner incloſure of a fortification, making an angle towards the field, and conſiſts of 2 faces, 2 flanks, and an opening towards the centre of the place, called the gorge: or it is rather a large maſs of earth, uſually faced with ſods, ſometimes with brick, but rarely with ſtone.

With regard to the firſt invention of baſtions, there are many opinions amongſt authors. Some have attributed this invention to Ziſca, the Bohemian; others to Achmet Baſhaw, who having taken Otranto in the year 1480, fortified it in a particular manner, which is ſuppoſed to be the firſt inſtance of the uſe of baſtions. Thoſe who wrote on the ſubject of fortification 200 years ago, ſeem to ſuppoſe, that baſtions were a gradual improvement in the ancient method of building, rather than a new thought, that any one perſon could claim the honour of. Be as it will, they were well known ſoon after the year 1500. For in 1546, Tartalea publiſhed his *Queſiti & inventioni diverſe,* in the 6th book of which he mentions, that whilſt he reſided at Verona (which muſt have been many years before) he ſaw baſtions of a prodigious ſize; ſome finiſhed, and others building: and there is beſides, in the ſame book, a plan of Turin, which was then fortified with 4 baſtions, and ſeems to have been completed ſome time before.

The great rule in conſtructing a baſtion is, that every part of it may be ſeen and defended from ſome other part: mere angles are therefore not ſufficient; but flanks and faces are neceſſary. The faces muſt not be leſs than 50 fathom, nor more than 65. The flanks are ſo much the better the longer they are, and muſt therefore ſtand at right angles with the line of defence. At the ſame time the diſpoſition of the flanks makes the principal part of a fortification, as on them the defence chiefly depends; and it is this that has introduced the various kinds of fortifying.

The angle of the baſtion muſt exceed 60°; otherwiſe it will be too ſmall to give room for the guns, and will either render the line of defence too long, or the flanks too ſhort. It muſt therefore be either a right angle, or ſome intermediate one between that and 60 degrees.

Gorge of a baſtion, the interval between the extremity of one flank and that of the next.

Solid baſtion. *Full baſtion.* A baſtion is ſaid to be ſolid or full, when the level ground within is even with the rampart; that is, when the inſide is quite level, the parapet being only more elevated than the reſt. They have this advantage over others, that they afford earth enough to make a retrenchment, in caſe the enemy lodge themſelves on the top of the baſtion, and the beſieged are reſolved to diſpute every inch of ground.

Hollow baſtion, *Empty baſtion,* is that where the level ground within is much lower than the rampart, or that part next to the parapet, where the troops are placed to defend the baſtion. The diſadvantage of theſe kinds of baſtions is, the earth being ſo low, that when an enemy is once lodged on the rampart, there is no making a retrenchment towards the centre, but what will be under the fire of the beſiegers.

Detached baſtion, is that which is ſeparated or cut off from the body of the place, and differs from a half-moon, whoſe rampart and parapet are lower, and not ſo thick as thoſe of the place, having the ſame proportion with the works of the place. Counter-guards with flanks are ſometimes called detached baſtions.

Cut baſtion, is that whoſe ſalient angle or point is cut off, inſtead of which it has a re-entering angle, or an angle inwards, with 2 points outwards; and is uſed either when the angle would, without ſuch a contrivance, be too acute, or when water, or ſome other impediment, prevents the baſtion from being carried to its full extent.

Compoſed baſtion, is when 2 ſides of the interior polygon are very unequal, which alſo renders the gorges unequal: it may not improperly be called a *forced baſtion,* being as it were forced into that form.

Deformed baſtion, is when the irregularity of the lines and angles cauſes the baſtion to appear deformed, or out of ſhape.

Demi-baſtion, is compoſed of one face only, has but one flank, and a demi-gorge.

Double baſtion, is that which is raiſed on the plane of another baſtion, but much higher; leaving 12 or 18 feet between the parapet of the lower, and the foot of the higher; and is ſometimes in the nature of a cavalier.

Regular baſtion, is that which has its true proportion of faces, flanks, and gorges.

Irregular baſtion, is that wherein the above equality of juſt proportion is omitted.

Barriers, in *fortification,* a kind of rails to ſtop the horſe or foot from ruſhing in upon the beſieged with violence.

Bonnet, in *fortification,* is a ſort of work placed before the ſalient angle of the ravelin to cover it: it conſiſts of 2 faces, parallel to the ravelin, or perpendicular to thoſe of the lunette. They are generally made 10 fathom broad at the ends, with a ditch of the ſame breadth, the covert-way 6, and the glacis 20 fathom.

Breach, in *fortification,* is an opening or gap made in a wall or rampart, with either cannon or mines, ſufficiently wide for a body of troops to enter the works, and drive the beſieged out of it.

Practical breach, is that where men may mount, and make a lodgement, and ſhould be 15 or 20 feet wide.

Caponier, is a paſſage made from one work to another, of about 10 or 12 feet wide, covered on each ſide by a parapet, terminating in a ſlope or glacis.

Caſcanes, in *fortification,* a kind of cellars made under the capital of a fortification; alſo ſubterraneous paſſages or galleries to diſcover the enemy's mines.

Caſemate, in *fortification,* is a work made under the rampart, like a cellar or cave, with loop-holes to place guns in it.

Cavalier, in *fortification,* is a work raiſed generally within the body of the place, 10 or 12 feet higher than the reſt of the works. Their moſt common ſituation is within the baſtion, and they are made much in the ſame form: they are ſometimes placed in their gorges, or on the middle of the curtain, and then are in the form of a horſe-ſhoe, only flatter.

The uſe of cavaliers is, to command all the adjacent works and country round them: they are ſeldom or never made but when there is a hill or riſing ground which overlooks ſome of the works.

Coffers. See COFFERS.

Covert-way, in *fortification*, is a ſpace of 6 fathom broad, going quite round the works, and is adjoined to the counterſcarp of the ditches, covered by a parapet 7½ feet high, including a banquette of 2½ feet, terminating in an eaſy ſlope towards the field, at a diſtance of 18 or 20 fathom.

Sometimes the covert-way is ſunk 2 or 3 feet below the horizon of the field; for, as ſuch works are never made to diſcover the enemy in their trenches, ſo this method of lowering the covert-way will give room for the fire of the lower curtain (in works that have one) to ſcour the eſplanade; and the expence of it ſhould be the moſt material objection againſt it.

Counterguard, in *fortification*, is a work placed before the baſtions to cover the oppoſite flanks from being ſeen from the covert-way; they are likewiſe made before the ravelins.

When counterguards are placed before the baſtions, they are eſteemed of very great uſe. They were firſt invented by Paſino, in 1579, and greatly improved by Speckle, in 1589.

Counterſcarp, in *fortification*, is properly the exterior talus of the ditch, or the further ſide from the body of the place, and facing it.

Crown-work, in *fortification*, is a kind of work not unlike a crown: it has 2 fronts and 2 branches. The fronts are compoſed of 2 half-baſtions and 1 whole one: they are made before the curtain or the baſtion, and generally ſerve to incloſe ſome buildings which cannot be brought within the body of the place, or to cover the town-gates, or elſe to occupy a ſpot of ground which might be advantageous to an enemy. They are of ſuch an expence, that they are rarely found in practice. The beſt uſe this work can poſſibly be put to, is to cover 2 joining curtains, when the ſides of it will be parallel to the ſides of the place, and it ſhould be fortified with the ſame ſtrength, and in the ſame manner.

The authors who have written on this work, have never thought of this uſeful part; and we often ſee 2 horn-works put in practice to cover 2 curtains, where the crown-work would do it much cheaper and much better.

Cordon, in *fortification*, is a round projection made of ſtone, in a ſemi-circular form, whoſe diameter is about 8 inches, and goes quite round the wall, and within 4 feet from the upper part.

Curtain, in *fortification*, is that part of the body of the place, which joins the flank of one baſtion to that of another. The ſtrait curtains have always been preferred to the different deſigns which have been propoſed, of which ſome have diminiſhed the expence, and (at the ſame time) the ſtrength of the place: others have ſomewhat augmented the ſtrength, but greatly diminiſhed its area.

Counter-forts, in *fortification*, are by ſome called *buttreſſes*: they are ſolids of maſonry, built behind walls, and joined to them at 18 feet diſtance from centre to centre, in order to ſtrengthen them, eſpecially when they ſuſtain a rampart or terras.

Cuvette, *Cunette*, in *fortification*, is a ſmall ditch of 10 or 12 feet broad, made in the middle of a large dry ditch, ſerving as a retrenchment to defend the ſame, or otherwiſe to let water into it, when it can be had in the time of a ſiege.

Demi-lune. See RAVELIN.

Detached baſtion. See BASTION.

Detached redout. See REDOUT.

Ditch, in *fortification*, is a large deep trench made round each work, generally from 12 to 22 fathom broad, and from 15 to 16 feet deep: the earth dug out of it ſerves to raiſe the rampart and parapet. Almoſt every engineer has a particular depth and breadth for ditches; ſome are for narrow ones and deep, others for broad ones and ſhallow; and it is moſt certain that ditches ſhould be regulated according to the ſituation. In regard to wet or dry ditches, almoſt all authors have given it in favour of the latter; and we ſhall only add, that the beſt of all are thoſe which can either be filled or kept dry at pleaſure.

Embraſures. See BATTERY.

Epaulement. See SIEGE.

Exterior ſide of a fortification, is the diſtance or imaginary line drawn from one point of the baſtion to that of the next.

Faces of the baſtion. See BASTION.

Faces, of any work, in *fortification*, are thoſe parts where the rampart is made, making an angle pointing outwards.

Faſcine. See BATTERY. See SIEGE.

Fauſſe-bray, in *fortification*, is a low rampart going quite round the body of the place; its height is about 3 feet above the level ground, and its parapet is about 3 or 4 fathom diſtant from that of the body of the place. Theſe works are made at a very great expence: their faces are very eaſily enfiladed, and by conſequence their flank ſeen in reverſe: the enemy is under cover the minute he becomes maſter of them; and a great quantity of ſhells which may be thrown into them, and muſt of neceſſity lodge there, will go near to make a breach in them, or at worſt to drive every one out. Hence they are liable to do more harm than good, and contribute no way to the defence of the place. Mr. Vauban, only makes them before the curtains, and as ſuch calls them tenailles.

Flanks, in *fortification*, in general, are any parts of a work, which defend another work along the outſides of its parapets.

Flanks of the baſtion, are the part between the face and curtain: the flank of one baſtion ſerves to defend the ditch before the curtain and face of the oppoſite baſtion.

Flanking is the ſame thing, in *fortification*, as defending.

Retired flanks, are thoſe made behind the line which joins the extremity of the face and the curtain, towards the capital of the baſtion.

Concave flanks, are thoſe which are made in the arc of a circle.

Direct or grazing flank, is that which is perpendicular to the oppoſite face produced, and oblique or fichant, when it makes an acute angle with that face.

Second flank. When the face of a baſtion produced does not meet the curtain at its extremity, but in ſome other point; then the part of the curtain between that point and the flank, is called the ſecond flank. The modern engineers have rejected this method of fortifying. See FLANK.

Fleche, a work of 2 faces, often conſtructed before the glacis of a fortified place, when threatened with a ſiege, in order to keep the enemy as long at a diſtance as poſſible.

Genouilliers, the undermoſt part of a battery, or the part from the platform to the embraſures.

Glacis, in *fortification*, is the part beyond the covert-way, to which it ſerves as a parapet, and terminates towards the field in an eaſy ſlope at about 20 fathom diſtance. Sometimes double glacis are made parallel to the eſplanade, and at the diſtance of 16 or 20 fathoms. Some authors think theſe works never anſwer the expence; however, M. Vauban was ſo ſenſible of their goodneſs, that he never failed to make them when he found the ground convenient for it; becauſe, when ſuch works are defended by a ſkilful governor, they will make a noble defence.

Gorge, of a baſtion, is the interval between the extremity of one flank and that of the other.

Gorge, of any work, is that part next to the body of the place, where there is no rampart or parapet; that is, at the counterſcarp of the ditch.

Hornwork, in *fortification*, is compoſed of a front and 2 branches: the front is made into 2 half-baſtions and a curtain: this work is of the nature of a crown-work, only ſmaller, and ſerves for the ſame purpoſes. The uſe of hornworks in general is to take poſſeſſion of ſome riſing ground advanced from the fortification; the diſtance of which determines that of the horn-work; and they are placed either before the curtain, or before the baſtions, according to circumſtances.

Horſe-ſhoe, is a ſmall round or oval work, with a parapet, generally made in a ditch, or in a marſh.

Half-moon. See RAVELIN.

Lodgements. See SIEGE.

Loop-holes, in *fortification*, are either ſquare or oblong holes, made in the wall, to fire through with muſkets.

Lunettes, in *fortification*, are works made on both ſides of a ravelin: one of their faces is perpendicular to half or 2-3ds of the faces of the ravelin, and the other nearly ſo to thoſe of the baſtions.

There are likewiſe lunettes, whoſe faces are drawn perpendicular to thoſe of the ravelin, within 1-3d part from the ſalient angle; whoſe ſemi-gorges are only 20 fathoms.

Theſe kinds of works make a good defence, and are of no great expence; for as they are ſo near the ravelin, the communication with it is very eaſy, and one cannot well be maintained 'till they are all three taken.

Lunettes, are alſo works made beyond the ſecond ditch, oppoſite to the places of arms: they differ from the ravelins only in their ſituation.

Lunettons, are ſmall lunettes.

Merlon, in *fortification*, that part of the breaſtwork of a battery, which is between the embraſures.

Orillon, in *fortification*, is a part of the baſtion near the ſhoulder, which ſerves to cover the retired flank from being ſeen obliquely: it is ſometimes faced with ſtone, on the ſhoulder of a cazematted baſtion, to cover the cannon of the retired flank, and hinder them from being diſmounted by the enemy's cannon.

Of all the works in a fortification, there is none more capable to defend the paſſage of the ditch, and to deſtroy the miner, whereſoever he enters himſelf, than the orillon. Experience in the laſt war has ſhewn us of what vaſt advantage it is to have 2 or 3 reſerve pieces of cannon, which command the ditch, and the face of the oppoſite baſtion, in ſuch a manner as to deſtroy the attempts of the miners, and ſee the breach in reverſe. Hence the great advantages of a double flank thus concealed, weigh ſo very much with us, and convince us ſo entirely of their uſefulneſs, that we affirm no place to be well fortified without the orillon, and that the ſtrait flank is fit fŏr nothing but field-works.

The orillon is as old as the baſtion, and was firſt made uſe of about the year 1480; and we find them frequent in the works of Paſino and Speckle, firſt publiſhed in 1579 and 1589.

Out-works. See Works.

Palliſades, in *fortification*, are a kind of ſtakes made of ſtrong ſplit wood of about 9 feet long, fixed 3 feet deep in the ground, in rows about 6 inches aſunder: they are placed in the covert-way, at 3 feet from, and parallel to the parapet of the glacis, to ſecure it from being ſurpriſed.

Parapet, in *fortification*, is a part of the rampart of a work, of 18 or 20 feet broad, and raiſed 6 or 7 feet above the reſt of the rampart: it ſerves to cover the troops placed there to defend the work againſt the fire of the enemy.

Parallels. See Siege.

Port-cullice, in *fortification*, is a falling gate or door, like a harrow, hung over the gates of fortified places, and let down to keep out the enemy.

Place of arms, in *fortification*, is a part of the covert-way, oppoſite to the re-entering angle of the counterſcarp, projecting outward in an angle. They are generally 20 fathoms from the re-entering angle of the ditch on both ſides, and the faces are found by deſcribing a radius of 25 fathoms.

Places of arms. See Siege.

Pits or *ponds*, in *fortification*, are little holes dug between the higher and lower curtains, to hold water, in order to prevent the paſſing from the tenailles to the flanks.

Profiles, in *fortification*, are repreſentations of the vertical ſections of a work; and ſerve to ſhew thoſe dimenſions which cannot be repreſented in plans, and are yet neceſſary in the building of a fortification: they may be very well executed and conſtructed upon a ſcale of 30 feet to an inch. By a profile are expreſſed the ſeveral heights, widths, and thickneſſes, ſuch as they would appear were the works cut down perpendicularly from the top to the bottom.

Rampart, in *fortification*, is an elevation of earth raiſed along the faces of any work, of 10 or 15 feet high, to cover the inner part of that work againſt the fire of an enemy: their breadths differ according to the ſeveral ſyſtems; for De Ville makes them 12½ fathoms, M. Vauban 6, and others 10 fathoms.

Rams-horns, in *fortification*, are a kind of low work made in the ditch, of a circular arc: they were firſt invented by Mr. Belidor, and ſerve inſtead of tenailles.

Ravelin, in *fortification*, is a work placed before the curtain to cover it, and prevent the flanks from being diſcovered ſideways: it conſiſts of 2 faces meeting in an outward angle. Some ravelins are counterguarded, which renders them as ſerviceable as either the cunettes or tenaillons.

Redans, in *fortification*, are a ſort of indented works, conſiſting of lines or faces that form ſallying or re-entering angles, flanking one another, and are generally uſed on the ſides of a river running through a garriſoned town. They were uſed before baſtions. Sometimes the parapet of the covert-way is carried on in this manner.

Redout, in *fortification*, is a kind of work placed beyond the glacis, and is of various forms. Their parapets, not being to reſiſt cannon, are only 8 or 9 feet thick, with 2 or 3 banquettes. The length of their ſides may be from 10 to 20 fathoms.

Redout, is alſo the name of a ſmall work, made ſometimes in a baſtion, and ſometimes in a ravelin, of the ſame form.

Redout, is likewiſe a ſquare work without any baſtions, placed at ſome diſtance from a fortification, to guard a paſs, or to prevent an enemy from approaching that way.

Detached redout, is a kind of work much like a ravelin, with flanks placed beyond the glacis: they are made to occupy ſome ſpot of ground which might be advantageous to the beſiegers; likewiſe to oblige the enemy to open their trenches farther off than they would do otherwiſe. Their diſtance from the covert-way ſhould not exceed 120 toiſes, that it may be defended by muſket-ſhot from thence.

Redouts-en-cremaillere, ſo called from their figure reſembling a pot-hook, the inſide line of the parapet being broken in ſuch a manner, as to reſemble the teeth of a ſaw; whereby this advantage is gained, that a greater fire can be brought to bear upon the defilé, than if only a ſimple face was oppoſed to it, and conſequently the paſſage is rendered more difficult.

Revetement, in *fortification*, is a ſtrong wall built on the outſide of the rampart and parapet, to ſupport the earth, and prevent its rolling into the ditch. When the revetement of a rampart goes quite up to the top, 4 feet of the upper part is a vertical wall of 3 feet thick, with a ſquare ſtone at the top of it, projecting about 5 or 6 inches, and a circular one below, or where the ſlope begins, of 8 or 10 inches diameter. They go quite round the rampart, and the circular projection is called the *cordon*.

Retrenchment, in *fortification*, is any work raiſed to cover a poſt, and fortify it againſt an enemy, ſuch as faſcines loaded with earth, gabions, ſand-bags, &c.

Retrenchment. See SIEGE.

Rideau, in *fortification*, is a ſmall elevation of earth, extending lengthways on a plane, and ſerving to cover a camp, or to give an advantage to a poſt. They are alſo convenient for the beſiegers of a place, as they ſerve to ſecure the workmen in their approaches to the foot of a fortreſs.

Rideau, is alſo uſed ſometimes for a trench, the earth of which is thrown up on its ſides, to ſerve as a parapet for covering the men.

Sap. See SIEGE.

Sillon, in *fortification*, a work raiſed in the middle of a ditch to defend it when too broad. This work has no particular form, but as it runs, forms little baſtions, half-moons, and redans, which are lower than the rampart of the place, but higher than the covert-way. It is not much uſed at preſent.

Talus, in *fortification*, are ſlopes made both on the outſide and inſide of every work, to prevent the earth's rolling down; and are of various denominations, viz.

Talus of the banquette, is that gentle ſlope from the top of the banquette to the horizontal line.

Interior talus of the parapet, the ſlope from the top of the parapet to the banquette.

Talus of the top of the parapet, that ſlope which leſſens the height of the parapet towards the berm, by which means the troops firing from the banquette can defend the covert-way.

Exterior talus of the parapet, the ſlope of the parapet from the top to the berme.

Interior talus of the ditch, the ſlope from the top of the ditch to the bottom, within.

Exterior talus of the ditch, is the ſlope from the top of the ditch to the bottom, without.

Traverſe, in *fortification*, is a parapet made croſs the covert-way, oppoſite to the ſalient angles of the works, and near the places of arms, to prevent enfilades; they are 18 or 20 feet thick, and as high as the ridge of the glacis. There are alſo traverſes made in the caponiers, but then they are called *tambours*.

Traverſes, are likewiſe made within other works, when there are any hills or riſing grounds which may ſee the inſides of theſe works. Traverſes that are made to cover the entrances of redouts in the field, need not be above 8 or 10 feet thick.

Tenailles, in *fortification*, are low works made in the ditch before the curtains; of which there are 3 ſorts. The firſt are the faces of the baſtions produced 'till they meet, but much lower; the ſecond have faces, flanks, and a curtain; and the third have only faces and flanks. Their height is about 2 or 3 feet higher than the level ground of the ravelin. Their uſe is to defend the bottom of the ditch by a grazing fire, as likewiſe the level ground of the ravelin, and eſpecially the ditch before the redout within the ravelin, which can be defended from no where elſe ſo well as from them.

Tenaillons, in *fortification*, are works made on each ſide of the ravelin, much like the lunettes; and only differ, in that one of the faces in a tenaillon is in the direction of the face of the ravelin; whereas that of the lunette is perpendicular to it.

Tower-baſtions, in *fortification*, are ſmall towers made in the form of baſtions; firſt invented by Mr. Vauban, and uſed in his ſecond and third method; with rooms or cellars underneath, to place men and artillery in them. As theſe towers are almoſt a ſolid piece of maſonry, they muſt be of great expence, though their reſiſtance can be but little; for it has been found by experience, that the caſemates are but of little uſe, becauſe as ſoon as they have fired once or twice, the ſmoke will oblige the defenders to leave them, notwithſtanding the ſmoke-holes: hence it may be concluded that the ſtrength of theſe tower-baſtions does by no means anſwer their expences; and that, if ſmall baſtions were made inſtead of them, without caſemates, they would be much better, and of leſs expence.

Terre-pleine, in *fortification*, the horizontal ſuperficies of the rampart, between the interior talus and the banquette.

Traditore, in *fortification*, ſignifies the concealed or hidden guns in a fortification, behind the reverſe of the orillon.

Trous-de-loup, in *fortification*, round holes made about 5 or 6 feet deep, with a ſtake in the middle: they are generally dug round a field redout, to obſtruct the enemy's approach; circular at top, and about 4½ feet diameter; pointed at the bottom like an inverted cone. Two or three rows of them are dug chequerwiſe, about 6 paces from the edge of the ditch, viz. two rows of holes exactly oppoſite to each other, and a third row in the middle, covering the intervals.

Zic-Zac. See SIEGE.

The principal maxims of fortification, are theſe, viz. 1. That every part of the works be ſeen and defended by other parts, ſo that the enemy can lodge no where without being expoſed to the fire of the place.

2. A fortreſs ſhould command all places round it; and therefore all the outworks ſhould be lower than the body of the place.

3. The works fartheſt from the centre ſhould always be open to thoſe that are nearer.

4. The defence of every part ſhould always be within the reach of muſket-ſhot, that is, from 120 to 150 fathoms, ſo as to be defended both by great and ſmall fire-arms; for if it be only defended by cannon, the enemy may diſmount them by the ſuperiority of their's, and then the defence will be deſtroyed at once; whereas, if a work is likewiſe defended by ſmall-arms, if the one is deſtroyed, the other will ſtill ſubſiſt.

5. All the defences ſhould be as nearly direct as poſſible; for it has been found by experience, that the ſoldiers are too apt to fire directly before them, without troubling themſelves whether they do execution or not.

6. A fortification ſhould be equally ſtrong on all ſides; otherwiſe the enemy will attack it in the weakeſt part, whereby its ſtrength will become uſeleſs.

7. The more acute the angle at the centre is, the ſtronger will be the place.

8. In great places, dry ditches are preferable to thoſe filled with water, becauſe ſallies, retreats, ſuccours, &c. are neceſſary; but, in ſmall fortreſſes, wet ditches, that can be drained, are the beſt, as ſtanding in need of no ſallies.

Field-Fortification, is the art of fortifying, conſtructing, attacking, and defending, all ſorts of temporary field-works during a campaign.

Different authors recommend different methods of fortification; but the principal are thoſe of Pagan, Blondel, Vauban, Coehorn, Belidor, Scheiter, and Muller.

Fortification, according to the method of Pagan, conſiſts in three different ſorts, viz. the great, the mean, and little, whoſe principal dimenſions are contained in the following

Table.

	The great Fortification.		The mean.		The little.	
	for ſquares	for all other polygons	for ſquares	for all other polygons	for ſquares	for all other polygons
Exterior ſide -	200	200	180	180	160	160
The perpendicular	27	30	24	30	21	30
The face - -	60	60	55	55	45	50
The flank - -	22	24 2	19 1	24	18 3	23 2
The curtain - -	73 2	70 5	63 4	60 4	63 5	50 4
The line of defence	141 4	141 2	126 1	126 5	115 5	112 3

Blondel fortifies within the given polygon: he eſtabliſhes two ſorts of fortification; the great one, whoſe exterior ſide is 200 toiſes, and the leſſer one 170; becauſe he will not have the line of defence exceed 140 toiſes, which is the greateſt muſket-ſhot, nor leſs than 120 toiſes, not to increaſe the number of baſtions. He begins by the diminiſhing angle, which may be found by taking 90 degrees from the angle of the polygon, and by adding 15 degrees to the third of the remainder.

Vauban's method is divided into little, mean, and great: the little is chiefly uſed in the conſtruction of citadels; the mean, in that of all ſorts of towns; and the great, in particular caſes only.

TABLE.

	Forts						Little				Mean		Great	
Side of polygon	80	90	100	110	120	130	140	150	160	170	180	190	200	260
Perpendicular	10	11	12½	14	15	16	20	21	23	25	30	31	25	22
Faces baſtion	22	25	28	30	33	35	40	42	45	47	50	53	55	60
Cap. of Ravel.	25	28	30	35	38	40	45	50	50	52	55	55	60	50

In the firſt vertical column are the numbers expreſſing the lengths of the exterior ſides from 80 to 260.

In the ſecond, the perpendiculars anſwering to theſe ſides.

In the third, the lengths of the faces of the baſtions; and in the fourth, the lengths of the capitals of the ravelins.

Belidor's method is divided alſo into little, mean, and great: and in all three the exterior ſide is 200 toiſes; the perpendicular of the little is 50, that of the mean 55, and the great 40: the faces of the firſt 70, the ſecond 70, and the third 55 toiſes.

Scheiter's method is divided into the great, mean, and ſmall ſort. The exterior ſide of the polygon for the great ſort is 200 toiſes, the mean ſort 180, and the ſmall 160. The line of defence in the firſt is 140 toiſes, the ſecond 130, and the third 120. This line is always razant. All the other lines are fixed at the ſame length for all polygons, whoſe ſtructure chiefly depends upon the knowledge of the exterior ſide, of the capital, or of the flanked angle, the reſt being eaſily finiſhed.——See the TABLE.

TABLE *of capitals and flanked angles.*

Polygons	IV	V	VI	VII	VIII	IX	X	XI	XII
The flanked angles in the 3 ſorts of fortification.	deg. 64	76	84	90	95	97	99	101	103
Capital for the great ſort.	toiſes 46	49	51	52	53	54½	56½	58	59
Capital for the mean ſort.	42	44½	46½	48½	50	51	52½	54	54
Capital for the ſmall ſort.	39	41½	42½	45	46	47½	48½	50	50½

FORTIN, FORTLETT. See FIELD-FORT.

FOSS, in *fortification*. See DITCH.

FOUCADE, FOUGADE, in *mining*. See FOUGASS.

FOUNDATION, in *military architecture*, is that part of a building which is under ground, or the maſs of ſtone, brick, &c. which ſupports a building, or upon which the walls of a ſuperſtructure are raiſed: or it is the coffer or bed dug below the level of the ground, to raiſe a building upon; in which ſenſe, the *foundation* either goes to the whole area or extent of the building, as when there are to be vaults, galleries, caſemates, or the like; or is drawn in cuts or trenches, as when only walls are to be raiſed. Sometimes the *foundation* is maſſive, and continued under the whole building, as in the antique arches and aqueducts; but it is more uſually in ſpaces or intervals; in which latter caſe, inſulated pillars, bound together by arches, ſhould be uſed.

There are ſeveral things to be well conſidered in laying the *foundation* of a military building. We muſt firſt examine the bed of the earth upon which we are to build, and then the under fillings or ſubſtruction. We are not to reſt upon any appearing ſolidity, unleſs the whole mould through which we cut has likewiſe been ſolid; and in ſuch caſes, allow 1-6th part of the height of the building for the hollowing or under-digging, unleſs there be cellars under ground, in which caſe it may be ſomething leſs.

There are many ways to try the firmneſs of the ground; but the following, in our opinion, is the beſt. Take an iron crow, or ſuch a borer as well-diggers uſe, which at once will point out the goodneſs and tenacity of the ground.

Engineers ſhould uſe the utmoſt diligence in this point; for, of all the errors that may happen in building, thoſe are the moſt pernicious which are committed in the foundation, becauſe they bring with them the ruin of the whole building; nor can they be amended without very great difficulty.

FOUNDATIONS are either natural, or artificial: natural, as when we build on a rock, or very ſolid earth; in which caſe we need not ſeek for any other ſtrengthening; for theſe, without digging, or other artificial helps, are of themſelves excellent *foundations*, and moſt fit to uphold the greateſt buildings. But if the ground be ſandy or marſhy, or have lately been dug, in ſuch caſe recourſe muſt be had to art. In the former caſe, the engineer muſt adjuſt the depth of the *foundation* by the height, weight, &c. of the building: 1-6th part of the whole height is looked upon as a medium; and as to the thickneſs, double that of the width of a wall is a good rule. If you build upon moſſy and looſe earth, then you muſt dig 'till you find ſound ground. This ſound ground, fit to ſupport a building, is of divers kinds: in ſome places ſo hard, as ſcarcely to be cut with iron; in other places very ſtiff; in other places blackiſh, which is accounted the weakeſt; in others like chalk, and in others ſandy: but of all theſe, that is the beſt which requires moſt labour in cutting or digging, and, when wet, does not diſſolve into dirt.

If the earth to be built upon is very ſoft, as in mooriſh grounds, or ſuch that the natural *foundation* cannot be truſted, then you muſt get good pieces of oak, whoſe length muſt be the breadth of the trench, or about 2 feet longer than the wall: theſe muſt be laid acroſs the *foundation*, about 2 feet aſunder, and being well rammed-down, lay long planks upon them; which planks need not lie ſo broad as the pieces are long, but only about four inches on a ſide wider than the baſis or foot of the wall is to be. But if the ground be ſo very bad, that this will not do, then you muſt provide good piles of oak, of ſuch a length as will reach the good ground, and whoſe diameter muſt be about 1-12th part of their length. Theſe piles muſt be driven down by an engine for that purpoſe, and muſt be placed as cloſe as one can ſtand by another; then lay planks upon them, and pin them faſt. But if the ground be faulty in ſome parts, and firm in others, you may turn arches over thoſe looſe places, which will diſcharge them of the weight. You muſt not forget to place the piles under the inner, as well as the outer walls; for if theſe ſhould ſink, it would be a means to make the outer walls crack, and ſo ruin the whole building.

Having thus far conſidered the bed of the earth on which the building is to be erected, we ſhall next conſider the ſubſtruction, as it was called by the ancients; but our modern engineers call it the *foundation*. This is the ground-work of the whole edifice, which muſt ſuſtain the walls, and is a kind of artificial, as the other was natural; as to which, theſe things that follow are moſt neceſſary to be obſerved. 1. That the bottom be exactly level; therefore lay a platform of good boards. 2. That the loweſt ledge or row be all of ſtone, the broader the better, laid cloſely without mortar; which is a general caution for all parts of a building that are contiguous to board or timber; becauſe lime and wood are utter enemies to one another, and, if unfit confiners any where, they are more eſpecially ſo in the foundation. 3. That the breadth of the *foundation* be at leaſt double the breadth of the wall that is to be raiſed upon it: but even in this caſe art ſhould give way to diſcretion; and the foundation may be made either broader or narrower, according as the ground, and the ponderoſity of the edifice, require. 4. That the *foundation* be made to diminiſh as it riſes, but yet ſo that there may be as much left on the one ſide as on the other; ſo that the middle of that above may be perpendicularly over the middle of that below, which ſhould in like manner be obſerved in diminiſhing the walls above ground; for by this means the building will become much ſtronger than it would be if the diminution were made any other way. 5. That you ſhould never build on the ruins of an old foundation, unleſs you are well aſſured of its depth, and that its ſtrength is ſufficient to bear the building.

The ſtones in the *foundation* ſhould be laid as they naturally lay in the quarry, for they have the moſt ſtrength in their natural poſition. This ſhould be obſerved in all parts of a building, becauſe all ſtones have a cleaving grain; conſequently, if the horizontal poſition of the ſtones in the quarry ſhould be placed vertically in the building, the ſuper-incumbent weight would be apt to cleave them, and ſo render the building ruinous.

FOUNDERY, FOUNDRY, in *military matters*, the art of caſting all kinds of ordnance, ſuch as cannon, mortars, howitzers, &c. It likewiſe ſignifies the place or work-houſe wherein theſe operations are performed. At preſent all pieces of artillery are caſt ſolid, and bored afterwards. Formerly guns were bored perpendicularly, but at preſent in a horizontal poſition: the boring inſtrument is fixed immoveably, and forced into the gun or mortar by a mechanical power. The piece of artillery is turned round by a large wheel and horſes; and at the ſame time the gun is bored, the outſide is turned and poliſhed, by another very curious machine for that purpoſe, invented by the very ingenious Meſſrs. Verbruggen, founders at Woolwich. Guns were firſt founded in England in 1587.

FOURNEAU, in *mining*. See CHAMBER. See MINE.

FOUGASS, in *mining*, a ſmall mine, from 6 to 8 feet under ground: they are generally placed under the glacis or dry ditches.

FOYER, in *mining*. See MINE.

FRAISE, in *fortification*, a kind of ſtakes or paliſades placed horizontally on the outward ſlope of a rampart made of earth, to prevent the work being taken by ſurpriſe. They are generally 7 or 8 feet long, and about 5 inches thick. When an army intrenches itſelf, they often fraiſe the parapets of their retrenchments in the parts moſt expoſed to an attack.

To FRAISE *a battalion*, is to line or cover it every way with pikes, that it may withſtand the ſhock of a body of horſe.

FRICTION, in *mechanics*, the rubbing of the parts of engines and machines againſt each other, by which a conſiderable part of their effect is deſtroyed.

It is hardly poſſible to lay down general rules for computing the quantity of friction, becauſe it depends upon a multiplicity of circumſtances, as the ſtructure, firmneſs, elaſticity, &c. of bodies rubbing againſt each other. Some authors make the friction upon a horizontal plane, equal to 1-3d of the weight to be moved; while others have found it to be conſiderably leſs. But however this be, the doctrine of friction, as aſcertained by the lateſt experiments, may be ſummed up in the following manner.

1. When one body reſts on another upon a horizontal plane, it preſſes it with its whole weight, which being equally re-acted upon, and conſequently the whole effect of its gravity deſtroyed by the plane, it will be abſolutely free to move in any horizontal direction by any the leaſt power applied thereto, provided both the touching ſurfaces be ſmooth.

2. But ſince we find no ſuch thing as perfect ſmoothneſs in the ſurfaces of bodies, ariſing from their poroſity and peculiar texture, it is eaſy to underſtand, that when two ſuch ſurfaces come together, the prominent parts of the one will, in ſome meaſure, fall into the concave parts of the other: and therefore, when an horizontal motion is attempted in one, the fixed prominent parts of the other will give more or leſs reſiſtance to the moving ſurface, by holding and retaining its parts; and this is what we call friction.

3. Now ſince any body will require a force equal to its weight, to draw it over a given obſtacle, it follows that the friction ariſing to the moving body, will always be in proportion to its weight only, and not to the quantity of the ſurface, by which it bears upon the reſiſting plane or ſurface. Thus if a piece of wood 4 inches wide, and 1 thick, be laid upon another fixed piece of the ſame wood, it will require the ſame weight to draw it along, whether it be laid on its broad or narrow ſide.

4. For, though there be 4 times the number of touching particles on the broad ſide (*cæteris paribus*) yet each particle is preſſed but with 1-4th of the weight that thoſe are on the narrow ſide; and ſince 4 times the number, multiplied by 1-4th of the weight, it is plain the reſiſtance is equal in both places, and ſo requires the ſame force to overcome it.

5. The reaſon why friction is proportional to the weight of the moving body, is, becauſe the power applied to move the body muſt raiſe it over the prominent parts of the ſurface on which it is drawn; and this motion of the body, as it is not upright, will not require a power equal to its whole weight; but being in the nature of the motion on an inclined plane, it will only require a part of its own weight, which will vary with the various degrees of ſmoothneſs and aſperity.

6. It is found by experiment, that a body will be drawn along by nearly 1-3d of its weight; and if the ſurfaces be hard and well poliſhed, by leſs than 1-3d part; whereas, if the parts be ſoft or rugged, it will require a much greater weight.

The ingenious Mr. Emerſon, in his principles of Mechanics, has given us the following rules deduced from experiments; but they require ſome variation under different circumſtances, which muſt be left to the judgment of the artiſt.

1. Wood and all metals, when greaſed, have nearly the ſame friction; and the ſmoother they are, the leſs friction they have; yet metals may be ſo far poliſhed as to increaſe friction by the coheſion of their parts.

Wood ſlides eaſier upon the ground in wet weather than in dry, and eaſier than iron in dry weather; but iron ſlides eaſier than wood in wet weather. Lead makes a great deal of reſiſtance. Iron or ſteel running in braſs, makes the leaſt friction of any. In wood acting againſt wood, greaſe makes the motion twice as eaſy, or rather 2-3ds eaſier. Wheel-naves, greaſed or tarred, go 4 times eaſier than when wet.

Metals oiled make the friction leſs than when poliſhed, and twice as little as when unpoliſhed.

In general, the ſofter or rougher the bodies, the greater their friction.

2. As to particular caſes: a cubic piece of ſoft wood of 8 pounds weight, moving upon a ſmooth plane of ſoft wood, at the rate of 3 feet per ſecond; its friction is about 1-3d of the weight of it; but if it be rough, the friction is little leſs than 1-half the weight.

Upon the ſame ſuppoſition, other ſoft wood upon ſoft wood very ſmooth, the friction is about 1-4th of the weight.

Soft wood upon hard, or hard wood upon ſoft, 1-5th or 1-half of the weight. Hard wood upon hard wood, 1-7th or 1-8th of the weight.

Poliſhed ſteel moving upon ſteel or pewter, 1-4th of the weight; moving on copper or lead, 1-5th of the weight; on braſs, 1-5th of the weight. Metals of the ſame ſort have more friction than different ſorts.

The friction, *cæteris paribus*, increaſes with the weight almoſt in the ſame proportion. The friction is alſo greater with a greater velocity, but not in proportion to it, except in very few caſes. A greater ſurface alſo cauſes ſomething more friction, with the ſame weight and velocity; yet friction may ſometimes be increaſed by having too little ſurface to move on; as upon clay, &c. where the body ſinks.

3. The friction ariſing from the bending of ropes about machines, differs according to their ſtiffneſs, the temper of the weather, degree of flexibility, &c. but, *cæteris paribus*, the force or difficulty of bending a rope is as the ſquare of the diameter of the rope, and its tenſion, directly; and the diameter of the cylinder or pully it goes about, reciprocally.

A rope of 1 inch diameter, whoſe tenſion or weight drawing it is 5 pounds, going over a pully 3 inches diameter, requires a force of 1 pound to bend it.

4. The reſiſtance of a plane moving through a fluid is as the ſquare of the velocity; and putting $v =$ velocity in feet in a ſecond; it is equal to the weight of a column of the fluid, whoſe baſe is the plane, and height $\frac{vv}{64}$. And in a globe it is but half ſo much.

5. As to the mechanic powers, the ſingle lever makes no reſiſtance by friction; but if, by the motion of the lever in lifting, the fulcrum, or place of ſupport, be changed further from the weight, the power will be decreaſed thereby.

6. In any wheel of any machine, running upon an axis, the friction on the axis is as the weight upon it, the diameter of the axis, and the angular velocity. This ſort of friction is but ſmall.

7. In the pulley, if p, q, be 2 weights, and q the greater; and $w = \frac{4pq}{p+q}$, then w is the weight upon the axis of the ſingle pulley; and it is not increaſed by the acceleration of the weight q, but remains always the ſame.

The friction of the pullies is very conſiderable, when the ſheaves rub againſt the blocks; and by the wearing of the holes and axles.

The friction of the axis of the pulley is as the weight w, its angular velocity, the diameter of the axis directly, and the diameter of the pulley inverſely. A power of 100 pounds, with the addition of 50 pounds, will but draw up 500 with a tackle of 5; and 15 pounds over a ſingle pulley will draw up only 14 pounds.

8. In the ſcrew, there is a great deal of friction: thoſe with ſharp threads have more friction than thoſe with ſquare threads; and endleſs ſcrews have more than either. Screws with a ſquare thread raiſe a weight with more eaſe than thoſe with a ſharp thread.

In the common ſcrew the friction is ſo great, that it will ſuſtain the weight in any poſition given, when the power is taken off; and therefore the friction is at leaſt equal to the power. From whence it will follow, that in the ſcrew, the power muſt be to the weight or reſiſtance, at leaſt as twice the perpendicular height of a thread, to the circumference deſcribed by one revolution of the power; if it be able to raiſe the weight, or only ſuſtain it. This friction of the ſcrew is of great uſe, as it ſerves to keep the weight in any given poſition.

9. In the wedge, the friction is at leaſt equal to the power, as it retains any poſition it is driven into; therefore in the wedge, the power muſt be to the weight at leaſt as twice the baſe to the height, to overcome any reſiſtance.

10. To find the friction of any engine, begin at the power, and conſider the velocity and the weight at the firſt rubbing part; and eſtimate its quantity of friction by ſome of the foregoing articles; then proceed to the next

rubbing part, and do the ſame for it, and ſo on through the whole.

And note, that ſomething more is to be allowed for increaſe of friction by every new addition to the power.

FRONT, *of a regiment*, the foremoſt rank of a battalion, ſquadron, or any other body of men. To front every way, is when the men are faced to all ſides.

FRONT *of a fortification*. See FACE.

FURLOUGH, in *military matters*, a licence granted by an officer to a ſoldier, to be abſent for a time from his duty. All ſoldiers found half a league from a camp or garriſon, going towards an enemy's country, or quarters, without a paſs, are deemed and treated as deſerters.

FUNERALS. See BURIALS.

FUZE. See LABORATORY.

FUZILIERS, in *military matters*, are ſoldiers armed as the reſt of the infantry, but wearing caps like the grenadiers, though ſomewhat ſhorter. There are three regiments in the Engliſh ſervice: the royal regiment of Scotch Fuziliers, raiſed in 1678; the royal regiment of Engliſh Fuziliers, raiſed in 1685; and the royal regiment of Welſh Fuziliers, raiſed in 1688-9.

FUZEE, or FUSEE. See FIRELOCK. See MUSKET.

FYF-MAJOR. See MAJOR.

G

GABIONS, in *fortification*, are a kind of baſkets made of ozier-twigs, of a cylindrical form, having different dimenſions, according to what purpoſe they are uſed. Some are 5 or 6 feet high, and 3 feet in diameter: theſe ſerve in ſieges to carry on the approaches under cover, when they come pretty near the fortification. Thoſe uſed in field-works are 3 or 4 feet high, and 2½ or 3 feet diameter. There is alſo a kind of gabions, about 1 foot high, 12 inches diameter at top, and from 8 to 10 at bottom, which are placed along the top of the parapet, to cover the troops in firing over it.

In order to make them, ſome pickets, 3 or 4 feet long, are ſtruck into the ground, in form of a circle. and of a proper diameter, wattled together with ſmall branches, in the manner of common fences. Batteries are often made of gabions. See BATTERY.

Stuft-GABIONS, in *fortification*, are made in the ſame manner as the former: they are only filled with all ſorts of branches and ſmall wood, and are 4 or 6 feet long: they ſerve to roll before the workman in the trenches, to cover them in front againſt muſket-ſhot.

GALLERY, {in *fortification*. See SIEGE.
{of a *mine*. See MINE.

GALLOPER-*Carriage*, in *artillery*. See CARRIAGE.

GANTLET, }
GAUNTLET, } in *ancient military hiſtory*, a large kind of glove, made of iron, and the fingers covered with ſmall plates: it was formerly worn by cavaliers, or ſingle knights of war, when armed at all points.

GANTLOPE, denotes a kind of military puniſhment, in which the criminal running between the ranks receives a laſh from each man. See *Run the gantlope.*

GARDENS, in our *ancient military hiſtory*, were of two different kinds, viz.

Artillery-GARDEN, about the year 1650, was a famous place in London, where vaſt numbers of young people took great delight in every kind of artillery exerciſes, in ſo far that it was famous through the whole world, and univerſally ſtiled the great nurſery, or academy of military diſcipline.

Military-GARDEN, was likewiſe famous, about the year 1650, in the city of London, for the great improvement of numbers of our nobility, and other gentlemen of faſhion, in every kind of military exerciſe. The captains in chief of thoſe academies or gardens were major-general Skippon, and major Tillyer.

GARNISH-*bolt*, or *nails*. See CARRIAGE.

GARRISON, in the *art of war*, a body of forces, diſpoſed in a fortreſs or garriſon town, to defend it againſt the enemy, or to keep the inhabitants in ſubjection; or even to be ſubſiſted during the winter ſeaſon: hence garriſon and winter-quarters are ſometimes uſed indifferently, for the ſame thing; and ſometimes they denote different things. In the latter caſe, a garriſon is a place wherein forces are maintained to ſecure it, and where they keep regular guard, as a frontier town, a citadel, caſtle, tower, &c. The garriſon ſhould always be ſtronger than the townſmen.

Winter-quarters ſignifies a place where a number of forces are laid up in the winter ſeaſon, without keeping the regular guard. See WINTER-QUARTERS.

Garrison-*town*, generally a ſtrong place in which troops are quartered, and do duty, for the ſecurity thereof, keeping ſtrong guards at each port, and a main-guard in or near the market-place.

Order of the GARTER, a military order of knighthood, the moſt noble and ancient of any lay-order in the world, inſtituted by king Edward III. This famous order conſiſts of 26 knights companions, generally princes and peers, whereof the king of England is the ſovereign or chief. They are a college or corporation, having a great and little ſeal.

Their officers are a prelate, chancellor, regiſter, king at arms, and uſher of the black rod. They have alſo a dean and 12 canons, and petty canons, vergers, and 26 penſioners, or poor knights. The prelate is the head. This office is veſted in the biſhop of Wincheſter, and has ever been ſo. Next to the prelate is the chancellor; which office is veſted in the biſhop of Saliſbury, who keeps the ſeals, &c. The next is the regiſter, who by his oath is to enter upon the regiſtry, the ſcrutinies, elections, penalties, and other acts of the order, with fidelity. The fourth officer is Garter, and king at arms, being two diſtinct offices united in one perſon. Garter carries the rod and ſceptre at the feaſt of St. George, the protector of this order, when the ſovereign is preſent. He notifies the elections of new knights, attends the ſolemnity of their inſtallations, carries the garter to the foreign princes, &c. He is the principal officer within the college of arms, and chief of the heralds.

All theſe officers, except the prelate, have fees and penſions. The college of the order is ſeated in the caſtle of Windſor, with the chapel of St. George, and the chapter-houſe, erected by the founder for that purpoſe. The habit and enſign of the order are, a garter, mantle, cap, george, and collar. The 4 firſt were aſſigned the knights companions by the founders; and the george and collar by king Henry VIII. The garter challenges pre-eminence over all other parts of the dreſs, by reaſon that from it the noble order is denominated; that it is the firſt part of the habit preſented to foreign princes, and abſent knights, who, and all other knights elect, are therewith firſt adorned; and it is of ſuch honour and grandeur, that by the bare inveſtiture with this noble enſign, the knights are eſteemed companions of the greateſt military order in the world. It is worn on the left leg, between the knee and calf, and is enamelled with this motto, *Honi ſoit qui mal y penſe*; that is, "Shame to him that thinks evil hereof." The meaning of which is, that king Edward having laid claim to the kingdom of France, retorted ſhame and defiance upon him that ſhould dare to think amiſs of the juſt enterpriſe he had undertaken, for recovering his lawful right to that crown; and that the bravery of thoſe knights whom he had elected into this order, was ſuch as would enable him to maintain the quarrel againſt thoſe that thought ill of it.

The mantle is the chief of thoſe veſtments made uſe of upon all ſolemn occaſions. The colour of the mantle is by the ſtatutes appointed to be blue. The length of the train of the mantle, only, diſtinguiſhes the ſovereign from the knights companions. To the collar of the mantle is fixed a pair of long ſtrings, anciently wove with blue ſilk only, but now twiſted round, and made of Venice gold and ſilk, of the colour of the robe, with buttons and taſſels at the end. The left ſhoulder of the mantle is adorned with a large garter, and device *Honi ſoit*, &c. Within this is the croſs of the order, which was ordained to be worn at all times, by king Charles I. At length the ſtar was introduced, being a ſort of croſs irradiated with beams of ſilver.

The collar is compoſed of pieces of gold in faſhion of garters, the ground enamelled blue, and the motto gold.

The garter is of blue velvet bordered with fine gold wire, having commonly the letters of the motto of the ſame: it is, at the time of election, buckled upon the left leg, by 2 of the ſenior companions, who receive it from the ſovereign, to whom it was preſented upon a velvet cuſhion by garter king at arms, with the uſual reverence, whilſt the chancellor reads the following admonition, enjoined by the ſtatutes. "To the honour of God omnipotent, and in memorial of the bleſſed martyr St. George, tie about the leg, for thy renown, this noble garter; wear it as the ſymbol of the moſt illuſtrious order, never to be forgotten, or laid aſide; that thereby thou mayeſt be admoniſhed to be courageous, and having undertaken a juſt war, in which thou ſhalt be engaged, thou mayeſt ſtand firm, valiantly fight, and ſucceſsfully conquer."

The princely garter being thus buckled on, and the words of its ſignification pronounced, the knight elect is brought before the ſovereign, who puts about his neck, kneeling, a ſky-coloured ribbon, whereon is appendant, wrought in gold within the garter, the image of St. George on horſeback, with his ſword drawn, encountering with the dragon. In the mean time the chancellor reads the following ad-

admonition: "Wear this ribbon about thy neck, adorned with the image of the bleſſed martyr and ſoldier of Chriſt, St. George, by whoſe imitation provoked, thou mayeſt ſo overpaſs both proſperous and adverſe adventures, that having ſtoutly vanquiſhed thy enemies both of body and ſoul, thou mayeſt not only receive the praiſe of this tranſient combat, but be crowned with the palm of eternal victory."

Then the knight elected kiſſes his ſovereign's hand, thanks his majeſty for the great honour done him, riſes up, and ſalutes all his companions ſeverally, who return their congratulations.

Since the inſtitution of this order, there have been 8 emperors, and 28 kings, beſides numerous ſovereign princes, enrolled as companions thereof. Its origin is ſomewhat differently related: the common account is, that it was erected in honour of a garter of the counteſs of Saliſbury, which ſhe dropped dancing with king Edward, and which that prince picked up; but our beſt antiquaries think it was inſtituted on account of the victory over the French at Creſſy, where the king ordered his garter to be diſplayed as a ſignal of the battle.

GATE, in a *military ſenſe*, is made of ſtrong planks with iron bars to oppoſe an enemy. They are generally made in the middle of the curtain, from whence they are ſeen and defended by the 2 flanks of the baſtions. They ſhould be covered with a good ravelin, that they may not be ſeen or enfiladed by the enemy. The paliſades and barriers before the gates within the town are often of great uſe. The fewer ports there are in a fortreſs, the more you are ſecured againſt the enemy. At the opening of a gate, a party of horſe is ſent out to patrole in the country round the place, to diſcover ambuſcades or lurking parties of the enemy, and to ſee if the country be clear.

GAUNTELOPE. } See GANTLOPE. *Run the*
GAUNTLET. } GANTLOPE.

GAZONS, in *fortification*, are pieces of freſh earth or ſods, covered with graſs, and cut in form of a wedge, about a foot long, and half a foot thick, to line the outſides of a work made of earth; as ramparts, parapets, banquettes, &c. The firſt bed of gazons is fixed with pegs of wood; and the ſecond bed is ſo laid as to bind the former, by being placed over its joints; and ſo continued 'till the works are finiſhed. Betwixt thoſe ſods it is uſual to ſow all ſorts of binding weeds or herbs, in order to ſtrengthen the rampart.

GENDARMES, } in the *French armies*, a
GENS D'ARMES, } denomination given to a ſelect body of horſe, on account of their ſucceeding the ancient gendarmes, who were thus called from their being completely clothed in armour. Theſe troops are commanded by captain-lieutenants; the king, and the princes of the blood, being their captains: the king's troop, beſides a captain-lieutenant, has 2 ſub-lieutenants, 3 enſigns, and 3 guidons. Eſtabliſhed in France in 1422.

Grand GENDARMES, at preſent are a troop compoſed of 250 gentlemen: the king himſelf is their captain, and one of the firſt peers their captain-lieutenant, who has under him 2 lieutenants, 3 enſigns, 3 guidons, and other officers.

Small GENDARMERY, are the Scotch gendarmes, the queen's, the dauphin's, the gendarmes of Anjou, Burgundy, the Engliſh and Flemiſh gendarmes, having each a captain-lieutenant, ſub-lieutenant, enſign, guidon, and quarter-maſter.

GENERAL, in a *military ſenſe*, is an officer in chief, to whom the prince has judged proper to intruſt the command of his troops; and this, whether he is known by the name of Captain-general, as in England and Spain, Feldt mareſchal, as in Germany, or Mareſchal, as in France.

The natural qualities of a GENERAL, ſhould be a martial genius, a ſolid judgement, a healthy robuſt conſtitution, intrepidity and preſence of mind on critical occaſions, indefatigability in buſineſs, goodneſs of heart, liberality, birth; the more illuſtrious it is, the more it commands reſpect: a reaſonable age; if too young, he may want experience and prudence; if too old, he may not have vivacity enough: an uniform conduct, an affable humour, but inflexible in maintaining the police and diſcipline of an army.

Acquired qualities of a GENERAL, are ſecrecy, juſtice, ſobriety, temperance, knowledge of the art of war from theory and practice, the art of commanding, and ſpeaking with preciſion and exactneſs; great attention to preſerve the lives and ſupply the wants of the ſoldiers, and a conſtant ſtudy of the characters of the officers of his army, that he may employ them according to their talents. His conduct appears in eſtabliſhing his magazines in the moſt convenient places; in examining the country, that he may not engage his troops too far, while he is ignorant of the means of bringing them off; in ſubſiſting them, and in knowing how to take the moſt advantageous poſts, either for fighting, retreating, or ſhunning a battle. His experience inſpires his army with confidence, and in aſſurance of victory; and his quality, by creating reſpect, augments his authority. By his liberality he gets intelligence of the ſtrength and deſigns of the enemy, and by this means is enabled to take the moſt ſucceſsful meaſures. He ought to be fond of glory, to have an averſion to flattery, to render himſelf beloved, and to keep a ſtrict diſcipline and a regular ſubordination.

The office of a GENERAL, is to regulate the march and encampment of the army; in the day of battle to chuſe out the moſt advantageous ground; to make the diſpoſition of the army; to poſt the artillery, and, where there is occaſion, to ſend his orders by his aids-de-camp. At a ſiege he is to cauſe the place to be inveſted, to regulate the approaches and attacks, to viſit the works, and to ſend out detachments to ſecure the convoy, and foraging parties.

GENERAL, is alſo uſed for a particular beat of the drum. See DRUM.

GENERALISSIMO, a ſupreme and abſolute commander in the field. This word is generally uſed in moſt foreign languages. (See GENERAL.) It was firſt invented by the abſolute authority of cardinal Richelieu, when he went to command the French army in Italy.

GENERAL *of the artillery*. See ORDNANCE.

GENERALS *of horſe*, are poſts next under the general of the army. They have an abſolute command over the horſe of an army, above the lieutenant-generals.

GENERALS *of foot*, are poſts next under the general of the army, having an abſolute command over the foot of the army. See GENERAL.

Adjutant-GENERAL, one who attends the general, aſſiſts in council, and carries the general's orders to the army. He diſtributes the daily orders to the majors of brigade. He is likewiſe charged with the general detail of the duty of the army. The majors of brigade ſend every morning to the adjutant-general an exact return, by battalion and company, of the men of his brigade. In a day of battle the adjutant-general ſees the infantry drawn up; after which, he places himſelf by the general, to receive any orders which may regard the corps of which he has the detail. In a ſiege, he orders the number of workmen demanded, and ſigns the warrants for their payment. He receives the guards of the trenches at their rendezvous, and examines their condition; he gives and ſigns all orders for parties. He has an orderly ſerjeant from each brigade of infantry in the line, to carry ſuch orders as he may have occaſion to ſend from the general.

Lieutenant-GENERAL, is the next in command after the general; and provided he ſhould die or be killed, the order is, that the oldeſt lieutenant-general ſhall take the command. This office is the firſt military dignity after that of a general. One part of their function is, to aſſiſt the general with their counſel: they ought therefore, if poſſible, to poſſeſs the ſame qualities with the general himſelf, and the more, as they often command armies in chief.

The number of lieutenant-generals have been multiplied of late in Europe, in proportion as the armies have become numerous. They ſerve either in the field, or in ſieges, according to the dates of their commiſſions. In battle the oldeſt commands the right wing of the army, the ſecond the left wing, the third the centre, the fourth the right wing of the ſecond line, the fifth the left wing, the ſixth the centre, and ſo on. In ſieges the lieutenant-generals always command the right of the principal attack, and order what they judge proper for the advancement of the ſiege, during the 24 hours they are in the trenches, except the attacks, which they are not to make without an order from the general in chief.

Lieutenant-GENERAL *of the ordnance.* See ORDNANCE.

Lieutenant-GENERAL *of artillery*, is, or ought to be, a very great mathematician, and an able engineer, to know all the powers of artillery, to underſtand the attack and defence of fortified places, in all its different branches; how to diſpoſe of the artillery in the day of battle to the beſt advantage; to conduct its march and retreat; as alſo to be well acquainted with all the numerous apparatus belonging to the train, and to the laboratory, &c.

Major-GENERAL, the next officer to the lieutenant-general: his chief buſineſs is to receive orders from the general, or in his abſence from the lieutenant-general of the day; which he is to diſtribute to the brigade-majors, with whom he is to regulate the guards, convoys, detachments, &c. On him the whole fatigue and detail of duty of the army roll. It is the major-general of the day who is charged with the encampment of the army, who places himſelf at the head of it when they march, who marks out the ground of the camp to the quarter-maſter-general, and who places the new guards for the ſafety of the camp.

The day the army is to march, he dictates to the field-officers the order of the march, which he has received from the general, and on other days gives them the parole.

In a fixed camp he is charged with the foraging, with reconnoitring the ground for it, and poſting the eſcorts, &c.

In ſieges, if there are two ſeparate attacks, the ſecond belongs to him; but if there is but one, he takes either from the right or left of the attack, that which the lieutenant-general has not choſen.

When the army is under arms, he aſſiſts the lieutenant-general, whoſe orders he executes.

If the army marches to an engagement, his poſt is at the head of the guards of the army, until they are near enough to the enemy to rejoin their different corps; after which he retires to his own proper poſt; for the major-generals are diſpoſed on the order of battle as the lieutenant-generals are, to whom, however, they are ſubordinate, for the command of their diviſions. The major-general has one aid-de-camp, paid for executing his orders.

GENIUS, in a *military ſenſe*, a natural talent or diſpoſition to every kind of warlike employment, more than any other; or the aptitude a man has received from nature to perform well, and eaſily, that which others can do but indifferently, and with a great deal of pains.

From the diverſity of genius, the difference of inclination ariſes in men, whom Nature has had the precaution of leading to the employments for which ſhe deſigns them, with more or leſs impetuoſity, in proportion to the greater or leſſer number of obſtacles they have to ſurmount, in order to render themſelves capable of anſwering this occaſion. Thus the inclinations of men are ſo very different, becauſe they follow the ſame mover, that is, the impulſe of their genius. This, as with the general in chief, is what renders one officer more pleaſing, even though he treſpaſſes againſt the rules of war; while others are diſagreeable, notwithſtanding their ſtrict regularity.

GENOUILLIERE. See FORTIFICATION.

GENS D'ARMES. See GENDARMES.

GEODŒSIA. See SURVEYING.

GEOGRAPHY, is the doctrine or knowledge of the terreſtrial globe; or the ſcience that teaches and explains the ſtate of the earth, and parts thereof that depend upon quantity: or it is rather that part of mixed mathematics, which explains the ſtate of the earth, and of its parts depending on quantity, viz. its figure, magnitude, place, and motion, with the celeſtial appearances, &c. In conſequence of this definition, geography ſhould be divided into general and ſpecial, or univerſal and particular.

By univerſal GEOGRAPHY, is underſtood that part of the ſcience which conſiders the whole earth in general, and explains its properties without regard to particular countries. This diviſion is again diſtinguiſhed into 3 parts, abſolute, relative, and comparative. The abſolute part reſpects the body of the earth itſelf, its parts and peculiar properties; as its figure, magnitude, and motion; its lands, ſeas, and rivers, &c. The relative part accounts for the appearances and accidents that happen to it from celeſtial cauſes; and, laſtly, the comparative contains an explanation of thoſe properties which ariſe from comparing different parts of the earth together.

Special or *particular* GEOGRAPHY, is that diviſion of the ſcience which deſcribes the conſtitution and ſituation of each ſingle country by itſelf; and is two-fold, viz. chorographical, which deſcribes countries of a conſiderable extent; or topographical, which gives a view of ſome place, or ſmall tract of land. Hence the object or ſubject of geography is the earth, eſpecially its ſuperficies and exterior parts.

The properties of GEOGRAPHY are of 3 kinds, viz. celeſtial, terreſtrial, and human. The celeſtial properties are ſuch as affect us by reaſon of the apparent motion of the ſun and ſtars. Theſe are 8 in number.

1. The elevation of the pole, or the diſtance of a place from the equator.

2. The obliquity of the diurnal motion of the ſtars above the horizon of the place.

3. The time of the longeſt and ſhorteſt day.

4. The climate and zone.

5. Heat, cold, and the ſeaſons of the year; with rain, ſnow, wind, and other meteors.

6. The riſing, appearance, and continuance of ſtars above the horizon.

7. The ſtars that paſs through the zenith of a place.

8. The celerity of the motion with which, according to the Copernican hypotheſis, every place conſtantly revolves.

The terreſtrial properties are thoſe obſerved in the face of each country, and are likewiſe 10 in number.

1. The limits and bounds of each country;

Its
2. figure;
3. magnitude;
4. mountains;
5. waters, viz. ſprings, rivers, lakes, and bays;
6. woods and deſerts;

7. The fruitfulneſs and barrenneſs of the country, with its various kinds of fruits;

8. The

8. minerals and foſſils ;
9. The living creatures there ;
10. longitude and latitude of the place.

The third kind of obſervations to be made in every country is called human, becauſe they chiefly regard the inhabitants of the place ; and theſe are alſo 10 in number.

1. Their ſtature, ſhape, colour, and the length of their lives ; their origin, meat and drink.

2. Their arts, and the profits which ariſe from them, with the merchandize they barter one with another.

3. Their virtues and vices, learning, capacities, and ſchools.

4. Their ceremonies at births, marriages, and funerals.

5. The language which the inhabitants uſe.

6. political government.
7. Their religion and church government.
8. cities and famous places.
9. remarkable hiſtories & antiquities

10. Their famous men, artificers, and inventions of the natives.

Theſe are the three kinds of occurrences to be explained in ſpecial geography.

The principles of GEOGRAPHY, or thoſe from which arguments are drawn for proving of propoſitions in that ſcience, are, according to the beſt authors, of three ſorts :

1. Geometrical, arithmetical, and trigonometrical propoſitions.

2. Aſtronomical precepts and theorems.

3. Experience, being that upon which the greateſt part of geography, and chiefly the ſpecial, is founded.

In proving geographical propoſitions, we are to obſerve, that ſeveral properties, and chiefly the celeſtial, are confirmed by proper demonſtrations ; being either grounded on experience and obſervation, or on the teſtimony of our ſenſes : nor can they be proved by any other means. There are alſo ſeveral propoſitions proved, or rather expoſed to view, by the terreſtrial globe, or by geographical maps.

Other propoſitions cannot be ſo well proved, yet are received as apparent truths. Thus, though we ſuppoſe all places on the globe, and in maps, to be laid down in the ſame order as they are really on the earth ; nevertheleſs, in theſe matters, we rather follow the deſcriptions that are given by geographical writers.

GEOGRAPHY is very ancient, at leaſt the ſpecial part thereof ; for the ancients ſcarce went beyond the deſcription of countries. It was a conſtant cuſtom among the Romans, after they had conquered or ſubdued any province, to have a map or printed repreſentation thereof, carried in triumph, and expoſed to the view of the ſpectators. Hiſtorians relate, that the Roman ſenate, about 100 years before Chriſt, ſent geographers into divers parts to make an exact ſurvey and menſuration of the whole globe ; but they ſcarce ever ſaw the 20th part of it.

Before them, Necho, king of Egypt, ordered the Phænicians to make a ſurvey of the whole coaſt of Africa, which they accompliſhed in 3 years. Darius procured the Ethiopic ſea, and the mouth of the Indus, to be ſurveyed ; and Pliny relates, that Alexander, in his expedition into Aſia, took 2 geographers to meaſure and deſcribe the roads ; and that from their itineraries, the writers of the following ages took many particulars. Indeed this may be obſerved, that whereas moſt other arts and ſciences are ſufferers by war, geography, artillery, mining, and fortification, alone have been improved thereby. Geography, however, muſt have been exceedingly defective, as a great part of the globe was then unknown, particularly all America, the northern parts of Europe and Aſia, with the Terra Auſtralis, and Magellanica ; and they were alſo ignorant of the earth's being capable to be ſailed round, and of the torrid zone's being habitable, &c.

The honour of reducing geography to art and ſyſtem, was reſerved for Ptolemy, who, by adding mathematical advantages to the hiſtorical method in which it had been treated of before, has deſcribed the world in a much more intelligible manner : he has delineated it under more certain rules, and by fixing the bounds of places from longitude and latitude, hath diſcovered other miſtakes, and has left us a method of diſcovering his own.

GEOMETRY, originally ſignified no more than the art of meaſuring the earth, or any diſtances or dimenſions within it ; but at preſent it denotes the ſcience of magnitude in general ; comprehending the doctrine and relations of whatever is ſuſceptible of augmentation or diminution, conſidered in that light. Hence, to geometry may be referred the conſideration not only of lines, ſurfaces and ſolids ; but alſo of time, velocity, number, weight, &c.

Plato thought the word geometry an improper name for this ſcience, and accordingly ſubſtituted in its place the more extenſive one of menſuration ; and, after him, others gave it the name of pantometry, as demonſtrating not only the quantities of all manner of magnitudes, but alſo their qualities, ratios, poſitions, transformations, relations, &c. and Proclus calls it the knowledge of magnitudes and figures, and their limitations ; alſo of their motions, and affections of every kind.

Origin and progreſs of GEOMETRY. This ſcience had its riſe among the Egyptians, who were in a manner compelled to invent it, to remedy the confuſion which generally happened in their lands, from the inundations of the river Nile, which carried away all their boundaries, and effaced all the limits of their poſſeſſions. Thus, this invention, which at firſt conſiſted only in meaſuring the lands, that every perſon might have what belonged to him, was called geometry, or the art of meaſuring land; and it is probable, that the draughts and ſchemes, which they were annually compelled to make, helped them to diſcover many excellent properties of theſe figures; which ſpeculations continued to be gradually improved, and are ſo to this day.

From Egypt geometry paſſed into Greece, where it continued to receive new improvements in the hands of Thales, Pythagoras, Archimedes, Euclid, &c. The elements of geometry, written by this laſt in 15 books, are a moſt convincing proof to what perfection this ſcience was carried among the ancients. However, it muſt be acknowledged, that it fell ſhort of modern geometry, the bounds of which, what by the invention of fluxions, and the diſcovery of the almoſt infinite order of curves, are greatly enlarged.

Diviſion of GEOMETRY. This ſcience is uſually diſtinguiſhed into elementary, and higher or ſublime geometry. The firſt, or elementary geometry, treats of the properties of right lines, and of the circle, together with the figures and ſolids formed by them. The doctrine of lines comes firſt, then that of ſurfaces, and laſtly that of ſolids. The higher geometry comprehends the doctrine of conic ſections, and numerous other curves.

Speculative and practical GEOMETRY. The former treats of the properties of lines and figures, as Euclid's Elements, Apollonius's Conic Sections, &c. and the latter ſhews how to apply theſe ſpeculations to the uſe of menſuration, navigation, ſurveying, taking heights and diſtances, gauging, fortification, gunnery, &c.

Uſefulneſs of GEOMETRY. The uſefulneſs of this ſcience extends to almoſt every art and ſcience. It is by the help of it that aſtronomers turn their obſervations to advantage; regulate the duration of times, ſeaſons, years, cycles, and epochas; and meaſure the diſtances, motion, and magnitudes, of the heavenly bodies. It is by it that geographers determine the figure and magnitude of the whole earth; and delineate the extent and bearings of kingdoms, provinces, harbours, &c. It is from this ſcience alſo, that architects derive their juſt meaſure and conſtruction of public edifices, as well as private houſes.

It is by the aſſiſtance of geometry that engineers conduct all their works, take the ſituation and plans of towns, the diſtances of places, and the meaſure of ſuch things as are only acceſſible to the ſight. It is not only an introduction to fortification, but highly neceſſary to moſt mechanics. On geometry likewiſe depends the theory of gunnery, mining, muſic, optics, perſpective, drawing, mechanics, hydraulics, pneumatics, &c.

GEORGE, *or Knight of St. George*, has been the denomination of ſeveral military orders, whereof that of the garter is one of the moſt illuſtrious. See GARTER.

GIN, in *military mechanics*, is a machine for raiſing great weights: it is compoſed of three long legs, two of which are kept at a proper diſtance by means of two iron bars fixed on one of the legs by a ſtaple paſſing through the hole at one end: the other end has a hook which enters into a ſtaple fixed into the other leg, ſo as to put off or on at pleaſure. At 3 feet from the bottom is a roller, upon which the cable is wound; and the 3 legs are joined together with an iron bolt, about which they move: to this bolt is alſo fixed an iron half-ring to hook on a windlaſs: when the gin ſtands upright, ſo as the legs ſtand at a proper diſtance, one end of the cable is faſtened to a gun, mortar, or other weight; and the other paſſes through the pullies and round the roller, which is turned round by means of hand-ſpikes paſſing through the holes in the ends of the roller: whilſt a man holds the cable tight, the gun is raiſed to the height that the carriage may be put under it.

GLACIS. See FORTIFICATION.

GLOBE. See GEOGRAPHY.

GORGE. See FORTIFICATION.

GORGET, a kind of breaſt-plate, like a half-moon, with the arms of the prince thereon; worn by the officers of foot. They are to be either gilt or ſilver, according to the colour of the buttons on the uniforms.

GORGONS, in *military antiquity*, a warlike female nation of Lybia, in Africa, who had frequent quarrels with another nation of the ſame ſex, called *Amazons*.

GOVERNOR *of a fortification*, is, or ſhould be, a perſon of great military knowledge; and is, however, a very conſiderable officer, repreſenting the king's perſon, whoſe authority extends not only over the inhabitants and garriſon, but over all troops that may be there in winter quarters, cantonments, or quarters of refreſhment.

Duty of a Governor *in time of peace*, is to order the guards, the rounds, and the patroles; to give the parole and counterſign every night after the gates are ſhut; to viſit the poſts, to ſee that both officers and ſoldiers do their duty, and to ſee that every thing goes on regularly, and in good order.

Duty of a Governor *in time of war*. He ſhould conſider the place in ſuch a manner, as if the enemy were going to beſiege him, not omitting the leaſt thing that may contribute to a long and obſtinate defence: he ſhould therefore take particular care to keep the fortification in good repair; clearing the country round of all hedges, ditches, trees, hollow roads, caverns, and riſing grounds, within the reach of cannon-ſhot; not ſuffering any houſes to be built within that diſtance, nor in general any thing to be done that may ſavour the approach of an enemy.

He ſhould conſider well with himſelf every minute circumſtance that may be of advantage to him during the ſiege: he ſhould thoroughly examine the ſeveral works, and canvaſs all the different ſtratagems that may be uſed, either to defend them, or to give way upon occaſion, when overpowered, with an intent to return and diſlodge the enemy, after they have got poſſeſſion of them; in ſhort, how to defend the place entruſted to his care, inch by inch, with the beſt advantage. He ſhould conſider how, and in what manner, the works defend each other; whether their communications are ſafe, or if they may be interrupted by the beſiegers; how to incommode the enemy when they are at a diſtance, or to diſlodge them when near; if the ground be proper for mines, and where they ſhould be made; if any part of the country may not be laid under water, by means of dikes or ſluices: if there are any already made, to keep them in conſtant repair, or to make them if they are wanted; taking care to conſtruct them ſo that the enemy may not have it in their power to deſtroy them, either with their cannon or mortars.

If the governor is not ſufficiently ſkilled in the attack and defence, he ſhould frequently converſe with the officers of engineers and artillery who underſtand it, examine the works together, to ſee what may be done to render the defence of the place as long as the circumſtances and nature of the works will admit of: and to make it familiar to himſelf, he ſhould ſet down a project of defence on paper, and have it canvaſſed by the moſt ſkilful officers of artillery, and engineers, about him. This muſt be done in private, that ſpies or deſerters may not diſcover the weak parts to the enemies. In ſhort, nothing ſhould be neglected on the part of the governor.

He ſhould ſee that the place be well ſupplied with plenty of ammunition, and wholeſome proviſions; that the hoſpitals are in good order, and provided with able phyſicians and ſurgeons, as likewiſe with every thing wholeſome and neceſſary, that the ſick and wounded may be well taken care of.

The powder-magazines, above all things, require his moſt ſpecial care: though they are built bomb-proof, yet, when a great number of ſhells fall upon them, they ſeldom reſiſt their ſhock; for which reaſon they ſhould be covered with 8 or 10 feet thick of earth, and a layer of faſcines, dung and ſtrong planks laid over them.

GRANADIER, } GRENADIER, } a foot ſoldier, armed with a firelock, bayonet, and hanger: they carry, beſides their arms, a cartridge-box that will hold 24 rounds, and a pouch filled with hand-grenades. They are clothed differently from the reſt of the battalion they belong to, by wearing a high cap, fronted with a plate of braſs, on which the king's arms is generally repreſented, &c. and a piece of cloth upon their ſhoulders, called a wing: even in ſome armies they have more pay than a common ſoldier. They are always the talleſt and briſkeſt men, conſequently the firſt upon all attacks. Every battalion of foot has generally a company of grenadiers belonging to it, which takes always the right of the battalion. Grenadiers were firſt inſtituted in France in 1667, by having 4 or 5 to each company; but in the year 1670, they were formed into companies, and in 1685, firſt known in England.

Horſe-Grenadiers, called by the French *grenadiers volans*, or flying-grenadiers, are ſuch as are mounted on horſeback, but fight both on foot and horſeback. They were firſt eſtabliſhed in France by Lewis XIV. in 1676, and formed into ſquadrons. We have in England two troops of horſe-grenadier guards, the firſt raiſed in the year 1693, and the command given to lieutenant-general Cholmondeley; the ſecond in 1702, and the command given to lord Forbes.

GRANADES, } GRENADES, } in the *art of war*, are hollow balls or ſhells, of iron or other metal, about 2½ inches diameter, which, being filled with fine powder, are ſet on fire, by means of a ſmall fuze, driven into the fuze-hole, made of well-ſeaſoned beech wood, and thrown by the grenadiers into ſuch places where men ſtand thick, and particularly into the trenches and other lodgements made by the enemy. As ſoon as the compoſition within the fuze gets to the powder in the grenade, it burſts into many pieces, greatly to the damage of all who happen to be in its way. Grenades were firſt invented about the time ſhells were invented (which ſee) and firſt uſed in 1594. Grenades have unaccountably ſunk into diſuſe; but I am perſuaded there is nothing more proper than to have grenades to throw into the midſt of the enemy, who have jumped into the ditch. During the ſiege of Caſſel, under the Count de la Lippe, in the campaign of 1762, a young engineer undertook to carry one of the outworks, with a much ſmaller detachment than one which had been repulſed, and ſucceeded with eaſe, from the uſe of grenades; which is a proof that they ſhould not be neglected, either in the attack or defence of poſts.

GRAPE-*ſhot*. See SHOT.

GRAPPLING-*irons*, in the *art of war*, are compoſed of 4, 5, or 6 branches, bent round and pointed, with a ring at the root, to which is faſtened a rope to hold by, when the grapple is thrown at any thing, in order to bring it near, ſo as to lay hold of it.

GROUND. See BREAK.

GROUND-*work*, in *military architecture*. See FOUNDATION.

GUARD, in the *military art*, is a duty performed by a body of men, to ſecure an army or place from being ſurpriſed by an enemy. In garriſon the guards are relieved every day; hence it comes that every ſoldier mounts guard once every 3 or 4 days in time of peace, and much oftener in time of war. See HONOURS.

Advanced GUARD, is a party of either horſe or foot, that marches before a more conſiderable body, to give notice of any approaching danger. Theſe guards are either made ſtronger or weaker, according to the ſituation or danger you may apprehend from the enemy, or the country you are to march through.

Van GUARD. See ADVANCED GUARD.

Artillery GUARD, is a detachment from the army to ſecure the artillery when in the field. Their corps de garde is in the front of the artillery park, and their centries diſperſed round the ſame. This is generally a 48-hours guard; and upon a march, this guard marches in the front and rear of the artillery, and muſt be ſure to leave nothing behind: if a gun or waggon breaks down, the officer that commands the guard is to leave a ſufficient number of men to aſſiſt the gunners and matroſſes in getting it up again.

Artillery quarter-GUARD, is frequently a non-commiſſioned officer's guard from the royal regiment of artillery, whoſe corps de garde is always in the front of their incampment.

Artillery rear-GUARD, conſiſts in a corporal and 6 men, poſted in the rear of the park.

Corps de GARDE, are ſoldiers entruſted with the guard of a poſt, under the command of one or more officers. This word alſo ſignifies the place where the guard mounts.

Counter GUARD. See FORTIFICATION.

Grand GUARD, three or four ſquadrons of horſe, commanded by a field-officer, poſted at about a mile, or a mile and a half from the camp, on the right and left wings, towards the enemy, for the better ſecurity of the camp.

Forage GUARD, a detachment ſent out to ſecure the foragers, who are poſted at all places, where either the enemy's party may come to diſturb the foragers, or where they may be ſpread too near the enemy, ſo as to be in danger of being taken. This guard conſiſts both of horſe and foot, and muſt remain on their poſts 'till the foragers are all come off the ground.

Main GUARD, is that from whence all other guards are detached. Thoſe who are for mounting guard aſſemble at their reſpective captain's quarters, and march from thence to the parade in good order; where, after the whole guard is drawn up, the ſmall guards are detached to their reſpective poſts: then the ſubalterns throw lots for their guards, who are all under the command of the captain of the main guard. This guard mounts in garriſon at different hours, according as the governor pleaſes.

Picquet GUARD, a good number of horſe and foot, always in readineſs in caſe of an alarm: the horſes are generally ſaddled all the time, and the riders booted.

The foot draw up at the head of the battalion, frequently at the beating of the tat-too; but afterwards return to their tents, where they hold themſelves in readineſs to march, upon any ſudden alarm. This guard is to make reſiſtance, in caſe of an attack, until the army can get ready.

Baggage GUARD, is always an officer's guard, who has the care of the baggage on a march. The waggons ſhould be numbered by companies, and follow one another regularly: vigilance and attention in the paſſage of hollow-ways, woods, and thickets, muſt be ſtrictly obſerved by this guard.

Ordinary GUARDS, ſuch as are fixed during the campaign, and relieved daily.

Extraordinary GUARDS, or detachments, which are only commanded on particular occaſions; either for the further ſecurity of the camp, to cover the foragers, or for convoys, eſcorts, or expeditions.

Quarter GUARD, is a ſmall guard commanded by a ſubaltern officer, poſted in the front of each battalion, at 222 feet before the front of the regiment.

Rear GUARD, that part of the army which brings up the rear on a march, generally compoſed of all the old grand-guards of the camp.

The rear guard of a party is frequently 8 or 10 horſe, about 500 paces behind the party. Hence the advance guard going out upon a party, form the rear guard in their retreat.

Rear GUARD, is alſo a corporal's guard placed in the rear of a regiment, to keep good order in that part of the camp.

Standard GUARD, a ſmall guard under a corporal, out of each regiment of horſe, who mount on foot in the front of each regiment, at the diſtance of 20 feet from the ſtreets, oppoſite the main ſtreet.

GUARDS, alſo imply the troops kept to guard the king's perſon, and conſiſt of both horſe and foot.

Horſe GUARDS, in England, are gentlemen choſen for their bravery and fidelity, to be entruſted with the guard of the King's perſon; and are divided into 4 troops, called the 1ſt, 2d, 3d, and 4th troop of horſe-guards. The firſt troop was raiſed in the year 1660, and the command given to lord Gerrard; the ſecond in 1659, and the command given to Sir Philip Howard; the third in 1665, and the command given to Earl Feverſham; the fourth in 1660, and the command given to Earl Newburgh. Each troop has a colonel, 2 lieutenant-colonels, 1 cornet and major, 1 guidon and major, 4 exempts and captains, 4 brigadiers and lieutenants, 1 adjutant, 4 ſub-brigadiers and cornets, and 60 private men.

Horſe-grenadier GUARDS, are divided into 2 troops, called the 1ſt and 2d troops of horſe-grenadier guards. The firſt troop was raiſed in the year 1693, and the command given to lieutenant-general Cholmondeley; the ſecond in 1702, and the command given to lord Forbes. Each troop has a colonel, lieutenant-colonel, 1 guidon or major, 3 exempts and captains, 3 lieutenants, 1 adjutant, 3 cornets, and 60 private men.

Yeomen of the GUARD, firſt raiſed by Henry VII. in the year 1485: they are a kind of pompous foot-guards to the king's perſon, and are generally called by a nick-name, the *beef-eaters*. They were anciently 250 men of the firſt rank under gentry, and of larger ſtature than ordinary, each being required to be 6 feet high. At preſent there are but 100 in conſtant duty, and 70 more not on duty; and when any one of the 100 dies, his place is ſupplied out of the 70. They go dreſſed after the manner of king Henry VIII's time. Their firſt commander or captain was the earl of Oxford, and their pay is 2 ſhillings and 6 pence per day.

Foot GUARDS, are regiments of foot appointed for the guard of his majeſty, and his palace. There are 3 regiments of them, called the 1ſt, 2d, and 3d regiment of foot-guards. They were raiſed in the year 1660, and the command of the firſt given to colonel Ruſſel, that of the ſecond to general Monk, and the third to the earl of Linlithgow. The firſt regiment is at preſent commanded by 1 colonel, 1 lieutenant-colonel, 3 majors, 23 captains, 1 captain-lieutenant, 31 lieutenants, and 24 enſigns; and contains 3 battalions. The ſecond regiment has 1 colonel, 1 lieutenant-colonel, 2 majors, 14 captains, 1 captain-lieutenant, 18 lieutenants, 16 enſigns; and contains only 2 battalions. The third regiment is the ſame as the ſecond. The firſt regiment of French guards was raiſed in the reign of Charles IX, in the year 1563.

Trench GUARD, only mounts in the time of a ſiege, and conſiſts ſometimes of 3, 4 or 6 battalions, according to the importance of the ſiege. This guard muſt oppoſe the beſieged when they ſally out, protect the workmen, &c.

Provoſt GUARD, is always an officer's guard that attends the provoſt in his rounds, either to prevent deſertion, maroding, rioting, &c. See PROVOST.

GUARD-*Magazine*. See STORE-KEEPER.

To be upon GUARD,—*To mount guard,*—*To relieve the guard,*---*The officer or ſerjeant of the guard*, are phraſes reſpecting the guard, and that every one knows.

GUARD, in *fencing*, implies a poſture proper to defend the body from the ſword of the antagoniſt.

GUERITTE, in *ancient military hiſtory*, is a centry-box, or centinel's box. See CENTRY-BOX.

GUIDES, in *military affairs*, are generally the country people in the neighbourhood where the army incamps: they are to give you intelligence concerning the country, the roads by which you are to march, and the route the enemy may take to come to you. Guides ſhould be faithful, becauſe, in giving you falſe intelligence, or guiding you wrong, they may greatly endanger the army. Several guides are requiſite, as every corps that marches by night ſhould have one at leaſt. There is ſometimes a captain, or chief of the guides, who ſhould be a man of parts, active, and attentive to the diligence and fidelity of his people. He ſhould always have a ſufficient number with him, and who are well acquainted with the country.

GUIDEFORE. See WAGGON.

GUIDEHIND. See WAGGON.

GUIDON, in *ancient military hiſtory*, the name of a ſort of ſtandard carried by the king's life-guards; ſo called from its being broad at one extreme, and almoſt pointed at the other, and ſlit, or divided into two.

GUIDON, alſo implies the officer who carries the guidon or ſtandard.

GUN, a fire-arm, or weapon of offence, which forcibly diſcharges a bullet through a cylindrical barrel, by means of gun-powder. See MUSKET.

Evening-GUN, is generally a 12-pounder, which fires every night about ſun-ſet, and every morning at ſun-riſe, to give notice to the drums and trumpets of the army, to beat and ſound the retreat and the reveille.

Great GUN. See CANNON.

GUNNER, in the *artillery*, is the ſecond rank of private men in the royal regiment of artillery.

Maſter GUNNER, one who teaches the men on ſhip-board to load and fire the guns: he is alſo a patent officer of the ordnance in garriſons.

GUNNERY, the art of determining the motions of bodies ſhot from cannon, mortars, howitzers, &c. See the article PROJECTILE.

The late ingenious Mr. Robins, having concluded from experiments, that the force of fired gun-powder, at the inſtant of its exploſion, is the ſame with that of an elaſtic fluid of a thouſand times the denſity of common air, and that the elaſticity of this fluid, like that of the air, is proportional to its denſity, propoſes the following problem.

The dimenſions of any piece of artillery, the weight of its ball, and the quantity of its charge being given; to determine the velocity which the ſhot will acquire from the exploſion, ſuppoſing the elaſticity or force of the powder at the firſt inſtant of its firing to be given.

In the ſolution of this important problem, he aſſumes the two following principles: 1. That the action of the powder on the ſhot ceaſes as ſoon as it is got out of the piece. 2. That all the powder of the charge is fired, and converting into an elaſtic fluid, before the ſhot is ſenſibly moved from its place.

Theſe aſſumptions, and the concluſions above mentioned, make the action of fired gun-powder to be entirely ſimilar to that of air condenſed a thouſand times; and from thence it will not be difficult to determine the velocity of the ſhot ariſing from the exploſion: for the force of the fired powder diminiſhing in proportion to its expanſion, and ceaſing when it is got out of the piece; the total action of the powder may be repreſented by the area of a curve, the baſe of which repreſents the ſpace through which the ball is accelerated, while the ordinates repreſent the force of the powder at every point of that ſpace; and theſe ordinates being in reciprocal proportion to their diſtance from the breech of the gun, becauſe when the ſpaces occupied by the fired powder are as 1, 2, 3, 4, &c. the ordinates repreſenting it will be as 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c. it appears that the curve will be a common parabola, and that the area intercepted between it, its aſymptote, and the two ordinates repreſenting the force of the powder at the firſt exploſion, and at the muzzle of the piece, will repreſent the total action of the powder on the ſhot: but if the ſhot were urged through the ſame ſpace by an uniform force equal to its gravity, the total action of this force would be repreſented by a rectangle, the baſe of which would be the baſe of the curve or intercepted portion of the aſymptote above mentioned, and the height of which would repreſent the uniform force of gravity. Hence the ſquare of the velocity of the ſhot reſulting from gravity is given, being the velocity it would acquire from a height equal to the ſpace through which the powder accelerates it; and the proportion between the hyperbola and the rectangle is given from the analogy between the hyperbolic paces and logarithms; therefore the velocity of the ball ariſing from the action of the fired gun-powder will be given.

Mr. Robins has alſo given us an ingenious way of determining, by experiments, the velocity which any ſhot moves with at any diſtance of the piece it is charged from.

This may be effected by means of a pendulum made of iron, having a broad part at bottom, covered with a thick piece of wood, which is faſtened to the iron by ſcrews; then having a machine like a common artillery-gin, on two of which poles, towards their tops, are ſcrewed ſockets, on which the pendulum is hung by means of a croſs piece, which becomes its axis of ſuſpenſion, and on which it ſhould vibrate with great freedom. Something lower than the bottom of the pendulum there ſhould be a brace, joining to which the pendulum is ſuſpended; and to this brace there is faſtened a contrivance made with two edges of ſteel, ſomething in the manner of a drawing-pen; the ſtrength with which theſe edges preſs on each other, being diminiſhed or increaſed at pleaſure, by means of a ſcrew. To the bottom of the pendulum ſhould be faſtened a narrow ribbon, which, paſſing between the ſteel edges, may hang looſely down by means of an opening cut in the lower piece of ſteel.

The inſtrument being thus fitted, if the weight of the pendulum, the reſpective diſtances of its centre of gravity, and of its centre of oſcillation from the axis of ſuſpenſion, be known, it may from thence be found, what motion will be communicated to this pendulum by the percuſſion of a body of a known weight, moving with a known degree of velocity, and ſtriking it in a given point; that is, if the pendulum be ſuppoſed to reſt before the percuſſion, it will be known what vibration it ſhould make in conſequence of ſuch a blow; and if the pendulum, being at reſt, is ſtruck by a body of a known weight, and the vibration which the pendulum makes after the ſtroke is known, the velocity of the ſtriking body may from thence be determined.

Now, the extent of the vibration, made by the pendulum, may be increaſed by the ribbon: for if the preſſure of the ſteel edges on the ribbon be regulated by the ſcrew, ſo as to be free and eaſy, though with ſome minute reſiſtance to hinder it from ſlipping of itſelf; then ſetting the pendulum at reſt, let the part of the ribbon between the pendulum and the ſteel edges be drawn ſtrait, but not ſtrained, and fixing a pin in the part of the ribbon contiguous to the edges, the pendulum, ſwinging back by means of the impulſe of the ball, will draw out the ribbon to the juſt extent of its vibration, which will be determined by the interval on the ribbon between the edges and the ſpace of the pin.

The computation by which the velocity of the ſhot is determined from the vibration of the pendulum, after the ſtroke, is founded on this principle of mechanics; that if a body in motion ſtrikes another at reſt, and they are not ſeparated after the ſtroke, but move on with one common motion, then that common motion is equal to the motion with which the firſt body moved before the ſtroke: whence, if that common motion and the maſſes of the two bodies are known, the motion of the firſt body before the ſtroke is thence determined. On this principle it follows, that the velocity of a ſhot may be diminiſhed in any given ratio, by its being made to impinge on a body of weight properly proportioned to it.

It is to be obſerved, that the length to which the ribbon is drawn, is always near the chord of the arc deſcribed by the aſcent; it being ſo placed, as to differ inſenſibly from thoſe chords which muſt frequently occur; and theſe chords are known to be in the proportion of the velocities of the pendulum acquired from the ſtroke. Hence it follows, that the proportion between the lengths of the ribbon, drawn out at different times, will be the ſame with that of the velocities of the impinging ſhots.

Now from the computations delivered by Mr. Robins, it appears, that the velocity of the bullet was 1641 feet in one ſecond of time, when the chord of the arc deſcribed by the aſcent of the pendulum, in conſequence of the blow, was 17¼ inches, the proportion of the velocity with which the bullets impinge, to the known velocity of 1641 feet in one ſecond, will be determined.

Mr. Robins is, I think (till of late) the only author who has attempted to aſcertain the velocity of a military projectile, by experiment; yet his concluſions ſeem to be unſatisfactory. Perhaps he was too much attached to the forming of a ſyſtem, and warped his experiments a little in favour of it. The reſiſting power he aſſigns to the air is probably too great; and his notion of the tripling of this power when the velocity of the projectile exceeds that of ſound, ſeems to be rather an ingenious conceit than a well-grounded fact. However, experiment alone muſt decide theſe points.

Experiments to determine the projectile curve, and velocity of the curve. Plate XII. fig. 1.

1. Let there be prepared, with great accuracy, a mortar, a ſolid ſhot, and a ſufficient quantity of powder, in order to preſerve an uniform force as nearly as poſſible.

2. Chuſe a convenient ſituation, and let

$RABCr$ be a horizontal plane, and $rabc$ the ſide of a hill, either regular or irregular; and from the ſtations R, A, B, C, let a ſhot or ſhell be projected, with the ſame charge and elevation, ſtriking the ſide of the aſcent or hill in the points r, a, b, c, reſpectively. At the ſtations A, B, C, let the angles rAa, rBb, rCc, be obſerved with an inſtrument; and alſo at a, b, c, obſerve the angles raB, rbB, rcC, which with the diſtances Ar, Br, Cr, will determine the amplitudes Aa, Ba, Ca: parallel to which amplitudes draw through R, the lines Rd, Re, Rf, each equal to its parallel amplitude, which will determine the points d, e, f, in the curve. And in like manner may many other points be determined.

Plate XII. fig. 2. The angle of incidence Rpt, at which the ſhell ſtrikes the ground, may be determined by erecting a ſmall ſtage, $abcd$, through which the ſhell may paſs at P, and ſtrike the ground at p; for then the direction Pp will ſhew the angle of incidence Rp, Pt. In ſmall elevations, a curtain might be placed near the extremities of the range R, r, which would determine PA, and A, R; and pa, and ar, and conſequently the angle of incidence arp. The abſciſs PA would ſhew how far the ball deviated from the curve of the parabola deſcribed on the actual range Rr. See Pl. XII. fig. 3.

Pl. XII. fig. 4. By a ſingular method on a deſcent, the continuation of the curve below the horizon may be determined. The vertex V of the curve is always nearer to r, the extremity of the range, than to the beginning of it, R; that is, RB is greater than Br. The vertex V muſt be determined by two obſervers with theodolites (or rather with ſuch an inſtrument as Mr. Robins meaſured the height of the aſcent of rocke's with) which will determine VB, RB, and Br.

The curve from the vertex V to the horizon r, will probably coincide very nearly with a parabola, as the horizontal velocity at the vertex is never very great.

Experiments tried by the MILITARY SOCIETY *at Woolwich in* 1765, *for the purpoſe of obtaining the initial velocities of ſhot.*

Theſe experiments were executed by a pendulum in imitation of Mr. Robins's, but greatly improved. The firſt was on the 13th day of May, 1775, it being a clear day; the weight of the pendulum = 328 lb. length from the axis to the ribbon = 102½ inches; from the axis to the centre of oſcillation = 88 inches; from the axis to the centre of gravity = 72 inches. Diſtance of the pendulum from the muzzle of the gun = 29 feet. The powder was common government's powder, put into flannel cartridges, gently rammed home, and without wad.

TABLE *of Experiments*, 13*th May*, 1775.

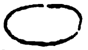
Rounds	Weight of powder	Weight of ſhot	Diameter of ſhot	Height of charge	Struck below the axis.	To the right or left	Chord of the arc	Velocity per ſecond
	oz.	inch.	inch.	inch.	inch.	inch.	inch.	feet
1	2	17½	1.98	——	92.5	0.8 R	13	457
2	2	17½	1.98	——	92.5	0.8 R	17.75	625
3	2	17½	1.98	3.15	91.6	0	18.1	644
4	2	17¼	1.97	3.15	91	1.5 R	17.6	640
5	2	17¼	1.97	3.15	90.5	0.3 R	16.3	595
6	2	17	1.96	3.1	92.4	1.8 L	16.2	588
7	4	17	1.97	4.5	92	1 L	24	863
8	4	17	1.96	4.5	90.5	0.3 R	25	927

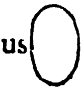
The penetrations were neglected, as very uncertain, on account of ſeveral ſhot ſtriking ſo near the ſame place. The quantity of it ſeemed to be about 3 inches in ſolid wood. The great difference between the velocity of the firſt ſhot, and all the reſt, muſt have been owing to ſome unperceived accident. The mean velocity among the reſt is 618 feet in a ſecond, with 2 oz. of powder: the mean weight of the balls is 17⅓ inches nearly; which velocity is about

1-6th part leſs than when the ſhot is 1-8th part heavier; owing, no doubt, to the windage attending the ſmaller ſhot. The mean between the two laſt with 4 oz. of powder is 895 feet, which alſo is proportionably leſs than when the ſhot is larger, ſo as to leave no windage. Moreover, theſe two velocities are nearly as 1. to 1.414, the ſquare roots of the quantities of powder.

Experiment II. 3d June, 1775. A clear day, but windy; when every thing was the ſame as the former day.

Rounds	Weight of powder	Weight of ſhot	Diameter of ſhot	Height of charge	Struck below the axis	To the right or left	Penetration	Chord of the arc	Velocity per ſecond
	oz.	oz.	inches	inches	inches	inches	inches	inches	feet
1	2	19½	2.08	2.85	88½	1½ R	—	24½	802
2	2	19½	2.08	2.85	89	0	6⅞	30½	1004
3	2	19½	2.08	2.85	93½	0	5⅜	30	940
4	2	19½	2.08	3.35	92½	0	5¼	57	755
5	2	19½	2.08	3.35	93	1 R	—	57	713
6	2	19½	2.08	3.3	92	½ R	5½	53	731

The firſt 3 rounds, the ſhot had no windage, conſequently the velocities much greater than thoſe of the firſt day's experiments. The 3 laſt rounds were made with long ſhot, whoſe form may be termed hemiſpherical-cylindrical, as they were terminated by hemiſpherical ends; ſo that their ſection through the axis was of this form  and the length near double of its breadth.

The 4th ſhot, or the firſt of the long kind, ſtruck the face of the pendulum ſideways, making a hole of the ſhape of the above ſection, differing in this however, that its length or axis was not horizontal, but vertical thus  The 5th ſhot ſtruck obliquely, neither exactly with its end or ſide foremoſt. Hence all long ſhot have an irregular rolling motion.

The penetrations were always meaſured to the hinder or outward end of the ſhot, as it lay in the wood.

Experiment III. 12th June, 1775; clear day and calm.

Rounds	Weight of powder	Weight of ſhot	Height of the charge	Struck below the axis	To the right or left	Chord of the arc	Diameter of the ſhot	Velocity per ſecond
	oz.	oz.	inches	inches	inches	inches	inches	feet
1	2	19½	2.85	94	0.5 R	23	2,080	700
2	2	18¼	2.85	94	0.	24½	2.036	796
3	2	18½	2.85	93½	1.6 R	22	2.045	708
4	4	19	4	92¼	0	27¾	2.062	866
5	4	18¼	4	93½	1 L	35	2.036	1141
6	4	18½	4	93½	0	33	2,045	1062

The whole weight of the pendulum = 324 lb.
Length to the centre of gravity = 71.4 inches.
Length to the centre of oſcillation = 88 inches.
Length from the axis to the ribbon = 102¼.
Diſtance of the gun 29 feet. Common-practice powder.

The mean weight of the firſt 3 ſhot is 18¾ ounces, and of the latter 3 ſhot 18½. Alſo the mean velocities, with 2 oz. and 4 oz. of powder, are 735 and 1023; which numbers are to each other as 1 to 1.4, that is, nearly as the ſquare roots of the quantities of powder.

Experiment IV. 20th July, 1775. A clear fine day.

Rounds	Weight of powder	Weight of ſhot	Diameter of ſhot	Height of the charge	Struck below the axis	To the right or left	Chord of the arc	Values of p.	Values of g.	Velocity per ſecond
	oz.	oz.	inches	inches	inches	inches	inches	lb.	inches	feet
1	2	28¼	2.021	2.85	90	1 R	14¾	552	78.0000	612
2	4	28¼	2.021	4.4	87	½ L	20¼	553¼	78.0316	883
3	8	28¾	2.032	7.1	87	½ L	27½	555½	78.0632	1168
4	2	28½	2.026	2.85	90	0	15	557¼	78.0948	624
5	4	28½	2.026	4.4	88	1 L.	20½	559	78.1·64	874
6	8	28¾	2.032	7.1	92	4¼ L	28½	560¾	78.1580	1158
7	2	28¼	2.021	2.85	89¾	1 L	14.3	562½	78.1896	608
8	4	28½	2.026	4.4	91¼	1½ L.	21	564¼	78.2212	874
9	8	28½	2.026	7.1	87	1 L	26.8	566	78.2528	1173

Weight of the pendulum = 552 lb. = p. Length to the centre of gravity = 78 inches = g. Length to the centre of oſcillation = 88 inches = n. Length from the axis to the ribbon = 101 inches. Gun and powder the ſame; but the ſhot were of lead.

The velocities calculated in this courſe were corrected by the proper allowance for the increaſe of the weight of the pendulum, by ſo many heavy balls lodging in it, and which gave occaſion for the 10th column, containing the ſeveral values of p, or the weight of the pendulum; the neceſſary allowance was alſo made for the alterations in the value of n, or place of the centre of oſcillation, and in the centre of gravity, or value of g, as ſpecified in the 11th column.

In the experiments of this day, the concluſions are very uniform and accurate; the mean velocity with 2 ounces of powder is 615 feet, with 4 ounces 877 feet, and with 8 ounces 1166 feet; which are to one another as the numbers 1, 1.426, and 1.9, that is, again, nearly as the ſquare roots of the quantity of powder. The mean weight of the balls is 28½ ounces nearly.

Experiment V. 21ſt Sept. 1775, between the hours of 2 and 6; it being a fine clear afternoon, rather windy, and the morning rainy.

Weight of the pendulum = 553 lb. = p. Length to the centre of gravity = 78.125 inches = g. Length from the axis to the ribbon = 101 inches; to the centre of oſcillation = 84.775 inches = n. The number of vibrations were 68 in 1.00 ſeconds. Diſtance of the gun = 30 feet. Powder as before.

Rounds	Powder	Shot in oz. and dr.		Weight of ſhot in lb.	Diameter of ſhot	Height of charge	Struck below axis	To the right or left	Cord of the arc	Values of p.	Values of g.	Velocity per ſecond
	oz.	oz.	dr.	lb.	inches	inch.	inches	inches	inches	lb.	inches	feet
1	2	19	0	1.1875	2.062	3	88.25	0.3 L	11.35	553.00	78.125	700
2	4	19	0	1.1875	2.062	4.3	88.25	0.3 L	17.3	554.24	78.147	1070
3	8	19	0	1.1875	2.062	6.3	91.0	0	23.6	555.54	78.169	1419
4	2	19	3¼	1.2012	2.070	3	90.65	1.5 R	11.35	556.80	78.196	679
5	4	19	8½	1.2208	2.081	4.3	90.65	1.5 R	17.3	558.10	78.223	1021
6	8	19	0¼	1.1904	2.064	6.7	90.65	1.5 R	22.3	559.41	78.240	1353
7	2	18	15	1.1838	2.060	3	91	0.8 R	11.35	560.60	78.266	692
8	4	18	14	1.1797	2.058	4.3	90	0.	15.3	561.99	78.293	948
9	8	18	9¼	1.1631	2.049	6.7	90	0	22.9	563.17	78.317	1443
10	2	18	9	1.1612	2.047	3	88.25	0.5 L	10.9	564.39	78.341	704
11	4	18	4½	1.1419	2.037	4.3	88.25	2.0 R	14.8	565.57	78.361	974
12	8	18	3¼	1.1396	2.036	6.7	88.25	2.0 R	20.6	566.86	78.381	1358
13	2	18	3	1.1367	2.034	3	92	1.25 R	11.35	568.00	78.401	723
14	4	18	3	1.1367	2.034	4.3	92	1.0 L	15.0	569.14	78.428	958
15	8	18	1½	1.1367	2.031	6.7	94.3	0.5 L	22.5	570.29	78.455	1412

Corrections of the variable quantities were made here very accurately, as in the laſt courſe. The weight of the wooden plugs, driven in to fill up the holes made by each ſhot, were alſo added to the pendulum.

The mean among all the velocities, with 2 ounces of powder, is 700; among thoſe with 4 ounces, is 994; and among thoſe with 8 ounces, is 1397: which are to one another as the 3 numbers 1, 1.42, and 2; that is, very nearly in the ratio of the ſquare roots of the quantities of powder. Alſo the mean weight of the balls, is nearly $18\frac{1}{3}$ ounces.

Moreover, by comparing the weight and velocities of the ſhot in this courſe, with thoſe in the courſe next before, it is found that the velocities, with the ſame quantities of powder, are very near reciprocally as the ſquare roots of the weights of the ſhot.

In the firſt place it may be obſerved, that the increaſe of velocity is very conſiderable by diminiſhing the windage, in ſo much that of ſhells or round ſhot, fired out of artillery, with the ſame quantity of powder, the larger ſhot has always a much greater velocity than the leſs one has; ſo that, by diminiſhing the windage, the momentum or force of the ſhot is much increaſed, as well by the increaſe of the velocity, as of the weight of the ſhot: and as it is the opinion of the founders of ſhot and cannon, that they can now work much truer than at the time when the preſent windage was firſt ſettled; it therefore ſeems, that the ſhot might (without any inconvenience) be ſo much increaſed, and the windage thereby decreaſed, that $\frac{1}{2}$ or $\frac{1}{3}$ of the preſent uſual quantity may produce as great an effect as the whole does now: hence $\frac{1}{2}$ or $\frac{2}{3}$ of the powder may be ſaved.

That increaſing the quantity of the charge does not increaſe the velocity, ſo much as at firſt ſight might be expected, and the range ſtill leſs; for a double charge gives but between $\frac{1}{2}$ and 1-3d more velocity, and the range will be ſcarcely 1-4th or 1-5th more.

By comparing together the effects of ſhot of different weights, it appears, that by increaſing or diminiſhing the weight of the ſhot (ſtill retaining the ſame diameter) does not alter the velocity proportionally; but only in ſuch proportion as the alteration juſt mentioned with regard to the quantity of powder; that is, a ſhot of double weight will move with a velocity but about 1-3d leſs than before; but its range will not be ſo much diminiſhed, becauſe its greater weight will better overcome the reſiſtance of the air. Hence, leaden ſhot will range as far, or farther, than iron ſhot: and therefore, if a hard and cheap metal could be obtained, as heavy as lead, it would be a great improvement in artillery. But ſuch improvement may alſo be effected by making hemiſpherical-cylindrical ſhot, as uſed in the ſecond experiment, as it from thence appears, that by lengthening the ſhot, and rounding its ends, it may be increaſed to double or triple the weight, without loſing any of the velocity, when the windage is ſufficiently diminiſhed. Shot of this kind would therefore be a very great improvement in artillery, for both land and ſea ſervice; for by this means, ſmall and light cannon may be made to throw ſhot of twice, thrice, or four times the weight of their proper round ſhot; thus be made to anſwer the end of the very heavieſt battering cannon; which will be a prodigious ſaving (beſides that of the powder) in the value or caſting of the guns, and making of the carriages, and likewiſe in the expence and trouble of conveying them with an army, or by ſea. Beſides, there is another advantage attending theſe ſhot for the ſea ſervice, which is, that they will do much more damage to ſhips, by rending and ſplintering them more than round ſhot can do, if theſe were even as heavy as the long ones. See Projectiles.

GUN-POWDER, a compoſition of ſalt-petre, ſulphur, and charcoal, well mixed together and granulated, which eaſily takes fire, and expands with amazing force.

Invention of Gunpowder, is uſually aſcribed to one Bartholdus Schwartz, a German monk, who diſcovered it about the year 1320; and the firſt uſe of it in war is commonly ſuppoſed to have been by the Venetians againſt the Genoeſe in the year 1380. Thevel ſays its inventor was one Conſtantine Anelzen, a monk of Friburg. Peter Mexia ſays it was firſt uſed by Alphonſus XI. king of Caſtile, in the year 1342. Ducange adds, that there is mention made of this powder in the regiſters of the chambers of accounts of France, ſo early as the year 1338; and our countryman, Friar Bacon, expreſsly mentions the compoſition in his treatiſe *De nullitate Magiæ*, publiſhed at Oxford in the year 1216. Some indeed are of opinion that the Arabians, or the latter Greeks, were the firſt inventors of gunpowder, about the middle ages of our æra; becauſe its Arabic name is ſaid to be expreſſive of its exploſive quality.

Method of making Gun-powder. Take ſalt-petre, ſulphur, and charcoal; reduce theſe to a fine powder, and continue beating them for ſome time in a ſtone mortar, with a wooden peſtle, wetting the mixture between whiles with water, ſo as to form the whole into an uniform paſte, which is afterwards reduced to grains, by paſſing it through a white ſieve for the purpoſe; and in this form, being carefully dried, it becomes the common gun-powder. For greater quantities, mills are uſed, by means of which more work may be performed in one day, than a man can do in a hundred. See Mill.

How to refine ſalt-petre. Put into a copper, or any other veſſel, 100 weight of rough nitre, with about 14 gallons of clean water, and let it boil gently for ½ an hour, and as it boils take off the ſcum; then ſtir it about in the copper, and before it ſettles put it into your filtering-bags, which muſt be hung on a rack, with glazed earthen pans under them, in which muſt be ſticks laid acroſs for the cryſtals to adhere to: it muſt ſtand in the pans for 2 or 3 days to ſhoot; then take out the cryſtals and let them dry. The water that remains in the pans, boil again for an hour, and ſtrain it into the pans as before, and the ſalt-petre will be quite clear and tranſparent; if not, it wants more refining; to do which proceed as uſual, 'till it is well cleanſed of all its earthy parts.

How to pulveriſe ſalt-petre. Take a copper kettle, whoſe bottom muſt be ſpherical, and put into it 14 lb. of refined ſalt-petre, with 2 quarts or 5 pints of clean water; then put the kettle on a ſlow fire; and when the ſalt-petre is diſſolved, if any impurities ariſe, ſkim them off, and keep conſtantly ſtirring it with 2 large ſpatulas, 'till all the water exhales; and when done enough, it will appear like white ſand, and as fine as flour: but if it ſhould boil too faſt, take the kettle off the fire, and ſet it on ſome wet ſand, which will prevent the nitre from ſticking to the kettle. When you have pulveriſed a quantity of ſalt-petre, be careful to keep it in a dry place.

Different kinds of Gun-Powder. It being proper that every one who makes uſe of powder, ſhould know of what it is compoſed, &c. Gun-powder, for ſome time after the invention of artillery, was of a compoſition much weaker than what we now uſe, or than that ancient one mentioned by Marcus Græcus: but this, I preſume, was owing to the weakneſs of their firſt pieces, rather than to their ignorance of a better mixture; for the firſt pieces of artillery were of a very clumſy, inconvenient make, being uſually framed of ſeveral pieces of iron bars, fitted together lengthways, and then hooped together with iron rings; and as they were firſt employed in throwing ſtone ſhot of a prodigious weight, in imitation of the ancient machines, to which they ſucceeded; they were of an enormous bore. When Mahomet II. beſieged Conſtantinople in the year 1453, he battered the walls with ſtone bullets, and his pieces were ſome of them of the calibre of 1200 lb.; but they could not be fired more than 4 times in the 24 hours, and ſometimes they burſt by the firſt diſcharge. Powder at firſt was not grained, but in the form of fine meal, ſuch as it was reduced to by grinding the materials together; and it is doubtful, whether the firſt graining of it was intended to increaſe its ſtrength, or only to render it more convenient for the filling it into ſmall charges, and the loading of ſmall-arms, to which alone it was applied for many years, whilſt meal-powder was ſtill made uſe of in cannon. But at laſt the additional ſtrength which the grained powder was found to acquire from the free paſſage of the fire between the grains, occaſioned the meal powder to be entirely laid aſide. The coal for making gun-powder, is either that of willow or hazle; but the lighteſt kind of willow is found to be the beſt, well charred in the uſual manner, and reduced to powder. Corned powder was in uſe in Germany as early as the year 1568; but firſt generally uſed in England in the reign of Charles I.

Government-Powder, } ſuch powder as, hav-
Ordnance-Powder, } ing undergone the cuſtomary proof eſtabliſhed by the board of ordnance, is received into the king's magazines.

Proof of Gun-Powder, *as practiſed by the board of ordnance.* They firſt take out of the ſeveral barrels of gun-powder, a meaſure full, of about the ſize of a thimble, which is ſpread upon a ſheet of fine writing-paper, and then fired: if the inflammation is exceeding rapid, the ſmoke riſes perpendicular, and the paper is neither burnt nor ſpotted, it is judged to be good powder.

Then 2 drams of the ſame powder is exactly weighed, and put into an eprouvette; which, if it raiſes a weight of 24 pounds to the height of 3½ inches, it is received into the king's magazines.

Gun-Powder Prover. See Eprouvette.

H

HABERGEON, in *military antiquity*, was a ſmall coat of mail, or only ſleeves and gorget of mail, formed of little iron rings, or maſhes linked into each other. See Gorget.

HABILIMENTS *of war*, in our *ancient ſtatutes*, ſignify armour, harneſs, utenſils, or other proviſions for war, without which there is ſuppoſed no ability to maintain a war.

HALBARD, } HALBERT, } in the *art of war*, a well-known weapon, carried by the ſerjeants of foot, and artillery. It is a ſort of ſpear, the ſhaft of which is about 5 feet long, made of aſh, or other wood. Its head is armed with a ſteel point, edged on both ſides. Beſides this ſharp point, which is in a line with the ſhaft, there is a croſs piece of iron, flat and turned down at one end, but not very ſharp; ſo that it ſerves equally to cut down, or puſh withall. It is more for ſhow than uſe.

The halbard is a very ancient weapon, being made uſe of by the Amazons, and afterwards by the Rhetians and Vindelicians about the year 570.

HALF-*Files*. See Files.

Half-*Moon*, or *demi-lune*. See Fortification.

HALT, is to diſcontinue the march of troops, to ſtand ſtill, to ſtop in order to reſt or perform any other motion; hence the word of command for troops to ſtop is, Halt.

HAIR-*Cloth*, uſed on the floor of powder magazines, and laboratories, to prevent accidents of fire from men's ſhoes treading or rubbing upon nails, ſand, or gravel, and ſo ſtriking fire.

HAND-*Barrow*, is made of light wood, and is of great uſe in fortification, for carrying earth from one place to another; or, in a ſiege, for carrying ſhells or ſhot along the trenches.

Hand-*Grenades*, are ſmall iron ſhells from 2.5 to 3 inches diameter, filled with powder, which being lighted by means of a fuze, are thrown by the grenadiers amongſt the enemy on ſundry occaſions.

Hand-*Screws*, are compoſed of a toothed iron bar, that has a claw at the lower end, and a fork at the upper; this bar is fixed in a ſtock of wood about 2.5 feet high, and 6 inches thick, moved by a rack-work; ſo that this claw or fork, being placed under a weight, raiſes it as far as the bar can go.

Hand-*Spikes*, in *gunnery*, are wooden levers 5 or 6 feet long, flattened at the lower end, and tapering towards the other; uſeful in moving guns to their places, after being fired and loaded again.

Hand-*Mallets*, are wooden hammers, with a handle, to drive fuzes and pickets, in making faſcine or gabion batteries, &c.

HASP, a flat ſtaple to catch the bolt of a lock. See Carriage.

HATCHET, uſed in the army, a ſmall light ſort of an ax, with a bazil edge on the left ſide, and a ſhort handle; uſed by the men for cutting wood to make faſcines, gabions, pickets, &c.

HAVERSACK, in a *military ſenſe*, is a kind of bag, made of ſtrong coarſe grey linen, to carry bread and proviſions on a march. They are only uſed in the field, and in cantonments, each ſoldier having one.

HEAD, in *gunnery*, the fore part of the cheeks of a gun or howitz carriage.

Head *of a work*, in *fortification*, is the front next to the enemy, and fartheſt from the place; as the front of a horn-work is the diſtance between the flanked angles of the demi-baſtions: the head of a double tenaille is the ſalient angle in the centre, and the two other ſides which form the re-entering angles. See Fort.

Head *of an army*, is the front, whether drawn up in lines, or on a march.

Head *of a double tenaille*, the ſalient angle in the centre, and the two other ſides which form the re-entering angle.

Head-*Piece*, armour for the head, an helmet, ſuch as the light dragoons wear.

Head *of a camp*, the ground before which the army is drawn up.

HELEPOLIS, in the *ancient art of war*, a machine for battering down the walls of a place beſieged: the invention of it is aſcribed to Demetrius the Poliorcete. Diodorus Siculus ſays, that each ſide of the *helepolis* was 450 cubits broad, and 90 in height; that it had 9 ſtages, and was carried on 4 ſtrong ſolid wheels, 8 cubits in diameter; that it was armed with huge battering-rams, and had 2 roofs capable of ſupporting them; that in the lower ſtages there were different ſorts of engines for caſting ſtones; and in the middle they had large catapultas for lancing arrows, with a number of expert men for working all theſe machines.

HELMET, an ancient defenſive armour, worn by the horſemen, both in war and tournaments. It covered both the head and face, only leaving an aperture in the front, ſecured by bars, which was called the viſor. The Carians firſt invented the boſs of ſhields and the creſt of helmets. In remembrance of this, a ſmall ſhield and a creſt were always buried with them. It is now entirely in diſuſe.

HELVES, or *Haſts*, the wooden handles of hatchets, hammers, or pick-axes, &c.

HEMERODROMI, in the *ancient art of war*, were a kind of centinels or guards appointed for the ſecurity and preſervation of cities and other places.

HENDECAGON, a figure that has 11 ſides, and as many angles, each capable of a regular baſtion.

HEPTAGON, a figure conſiſting of 7 ſides, and as many angles. If the ſides be all equal, it is called a regular *heptagon*, &c.

HEPTAGONAL *numbers*, are a ſort of polygonal numbers, wherein the difference of the terms of the correſponding arithmetical progreſſion is = 5. One of the properties of theſe numbers is, that if they be multiplied by 40, and 9 be added to the product, the ſum is a ſquare number.

HERALD, an officer at arms, whoſe buſineſs it is to declare war, to proclaim peace, to marſhal all the ſolemnities at the coronation, chriſtening, marriage, and funeral, of princes and great generals.

HERRISON, in *fortification*, a beam or barrier made of one ſtrong piece of wood, full of iron ſpikes. It is generally ſupported in the middle, and turns upon a pivot or axis. Its uſe is to ſtop up any paſſage, though frequently placed before the gates, and more eſpecially the wicket-doors of a town or fortreſs; to ſecure thoſe paſſages, which muſt of neceſſity be often opened and ſhut.

HERO, in a *military ſenſe*, is a great, illuſtrious, and extraordinary perſonage; particularly in reſpect of valour, courage, intrepidity, and other military virtues. Modern authors make a diſtinction between a hero, and a great man; that the former is more daring, fierce, and enterpriſing; and the latter more prudent, thoughtful, and reſerved. In this ſenſe we ſay, Alexander was a hero, and Julius Cæſar a great man.

HERSE, in *fortification*, ſtrong pieces of wood jointed croſs-ways, like a lattice or harrow, and ſtuck full of iron ſpikes. It is uſually hung by a rope, faſtened to a molinet, which is cut in caſe of a ſurpriſe, or when the firſt gate is forced by ſurpriſe, or with a petard, to the end that it may fall and ſtop the paſſage of the gate, or other entrance of a fortreſs.

Theſe *herſes* are alſo often laid in the roads, with the points upwards, inſtead of the chevaux-de-frize, to incommode the march of both horſe and foot. Common harrows are ſometimes made uſe of in caſe of haſte, and turned with their points upwards.

HERSILLON, in the *military art*, is for the ſame uſe as the herſe, and is made of one ſtrong beam, about 10 or 12 feet long, whoſe two ſides are ſtuck full of ſpikes, to incommode both horſe and foot. The word is a diminutive of the preceding.

HEXŒDRON, one of the platonic, or 5 regular bodies, being a ſolid conſiſting of 6 equal ſides or faces, popularly called a cube.

HEXAGON, is a figure of 6 ſides, and as many angles, capable of being fortified with 6 baſtions. If the ſides and angles be equal, it is called a regular hexagon. The ſide of a regular hexagon inſcribed in a circle, is equal to the radius of that circle; hence a regular hexagon is inſcribed in a circle, by ſetting the radius of 6 times upon the periphery: as 1 to 1.672, ſo is the ſquare of the ſide of any regular hexagon to the area thereof nearly.

Tanned HIDES, are always carried along with an army, eſpecially in the laboratory's ſtores, to protect powder or ſhells from rain: they are alſo uſed upon batteries, and in laboratories.

HINGES, are two iron bands, with a joint nailed to the doors or lockers of gun-carriages to faſten them, and move them backwards and forwards.

HISTORY, a narration or deſcription of the ſeveral tranſactions, actions, or events of a ſtate, king, or private perſon, in the order in which they happened.

Military HISTORY, a faithful narrative of military tranſactions, campaigns, battles, ſieges, marches, &c. of an army: likewiſe a relation of the heroic actions of great generals, &c.

HOBITS. See HOWITZ.

HOLLOW-*Square*, a body of foot drawn up with an empty ſpace in the middle, for the colours, drums, and baggage, &c. See SQUARE.

HOLLOW-*Tower*, is a rounding made of the remainder of 2 briſures, to join the curtain to the orillon, where the ſmall ſhot are played, that they may not be ſo much expoſed to the view of the enemy.

Order of the Holy-Ghost, the principal military order in France, inſtituted by Henry III. in 1569. It conſiſts of 100 knights, who are to make proof of their nobility for three deſcents. The king is the grand maſter, or ſovereign, and as ſuch, takes an oath, on his coronation-day, to maintain the dignity of the order. The knights wear a golden croſs, hung about their necks by a blue ſilk ribband, or collar: but before they receive this order of the Holy-Ghoſt, that of St. Michael is conferred, as a neceſſary degree; and for this reaſon their arms are ſurrounded with a double collar.

HONEY-*Combs*, in *cannon*, flaws in the metal, a fault in caſting, and dangerous in firing. The board of ordnance rejects all guns (on proof) having an honey-comb of $\frac{4}{10}$ of an inch deep, as being unfit for ſervice.

HONOUR, in a *military ſenſe*, is a vague expreſſion, to which cuſtom has given different meanings. Honour conſiſts in the conſtant practice of virtue. Ariſtotle calls it the recompence of virtue; the teſtimony of the excellence of a man who diſtinguiſhes himſelf by virtue. An Italian writer calls it a ſtate of inviolable dignity, above all calumny, and all ſuſpicion. Honour gives many advantages; it procures us the conſideration of the public; it gives weight to our actions; it advances our fortunes. The beſt recompence of a brave action is, undoubtedly, the ſatisfaction of having done it; but nevertheleſs the honour reſulting to us from it is a real good, which ſhould be dear to us.

Military Honours. All armies ſalute crowned heads in the moſt reſpectful manner, drums beating a march, colours and ſtandards dropping, and officers ſaluting. Their guards pay no compliment, except to the princes of the blood; and even that by courteſy, in the abſence of the crowned head.

To the commander in chief the whole line turns out without arms, and the camp-guards beat a march, and ſalute.

To generals of horſe or foot, beat a march and ſalute.

Lieutenant-generals of ditto, three ruffs, and ſalute.

Major-generals of ditto, two ruffs, and ſalute.

Brigadiers of ditto, reſted arms, one ruff, and ſalute.

Colonels of ditto, reſted arms, and no beating. Centinels reſt their arms to all field-officers, and ſhoulder to every officer.

All governors, that are not general-officers, ſhall, in all places where they are governors, have one ruff, with reſted arms; but for thoſe who have no commiſſion as governors, no drum ſhall beat.

Lieutenant-governors ſhall have the main-guard turned out to them with ſhouldered arms.

Pruſſian Honours *of war*, chiefly imitated by moſt powers in Europe, are,

To the king all guards beat the march, and all officers ſalute.

Field-marſhals received with the march, and ſaluted in the king's abſence.

Generals of horſe or foot, four ruffs; but if he commands in chief, a march and ſalute.

Lieutenant-generals of horſe or foot, (commanding or not) guards beat three ruffs.

Major-generals of horſe or foot, two ruffs.

Officers, when their guards are under arms, and a general makes a ſignal, muſt reſt to him, but not beat; when not got under arms, and a ſignal made, only ſtand by their arms.

Village-guards go under arms only to the king, field-marſhals, generals of horſe and foot, and to the general of the day.

Generals guards go under arms only to the king, field-marſhals, and the general over whom they mount.

Commanding officers of regiments, and battalions, their own quarter and rear guards to turn out; but not to other field-officers, unleſs they are of the day.

Generals in foreign ſervice, the ſame.

Honours *paid by centinels.*

Field-marſhals, two centinels with ordered firelocks, at their tent or quarters.

Generals of horſe or foot, two centinels, one with his firelock ſhouldered, the other ordered.

Lieutenant-generals, one, with firelock ordered.

Major-generals, one, with firelock ſhouldered.

The firſt battalion of guards go under arms to the king only; not to ſtand by, nor draw up in the rear of their arms to any other; nor to give centinels to foreigners. Second and third battalions draw up behind their arms to the princes, and to field-marſhals; but when on grenadier-guards, or out-poſts, they turn out, as other guards do, to the officers of the day. They give one centinel with ſhouldered arms to the princes of the blood, and to field-marſhals, when they lie alone in garriſon.

Guards on Honour *in Pruſſia.*

The king, what he pleaſes.

Field-marſhal and commander in chief, 1 lieutenant, 2 non-commiſſioned officers, and 40 men, to guard his baggage, &c. If the king is preſent, but 1 lieutenant, 1 non-commiſſioned officer, and 20 men.

General of foot, 1 enſign, 1 non-commiſſioned officer, and 15 men; but when he commands a detachment, 1 lieutenant, and 30 men.

Lieutenant-general, 1 non-commiſſioned officer, and 15 men. Ditto on detachments, 1 enſign, and 20 men.

Major-general, 1 non-commiſſioned officer, and 12 men.

Grand-magazine-guard depends on the greater or leſs quantity of proviſions.

Surgeon's cheſt, and ſolicitor-general's, remain in the neareſt covered town.

Provoſt-general's guard depends on the number of his priſoners.

Artillery provide their own guard.

Lieutenant and major-general's guard, from their brigades.

Field-marſhals and generals of foot, by their own regiments.

Generals guards formed by the eldeſt adjutants, after the quarter-guards are mounted, &c.

Generals guards to have pickets on the right of their tents.

HONOURS *paid to the King, &c. by garriſons in Pruſſia.*

When they permit, to fire a triple diſcharge of all the cannon, half-loaded.

Field-marſhal, ſingle diſcharge of 9 cannon, with half-loading; guards to beat a march, and officers ſalute.

Guards pay the ſame compliments to general officers in garriſon as in camp.

Colonel, when commandant; all guards reſt their arms, and port-guards ſhoulder their arms. Other guards reſt. Centinels reſt their arms to all field-officers.

HONOURS *by* GUARDS, *as a compliment to general officers, &c. with the detail of officers and men they are entitled to in the Engliſh army.*

GUARDS	Captains	Lieutenants	Enſigns	Serjeants	Drummers	Fifers	Private men
The general in chief has - -	1	1	1	2	2	2	50
General of horſe and foot - -	1	1	1	2	2	2	50
Lieut. gen. of horſe and foot -	—	1	—	1	1	1	30
Major-general of horſe and foot -	—	—	1	1	1	1	20
Brigadier - - - - -	—	—	—	1	—	—	12
Quarter-maſter-general - -	—	—	—	1	—	—	12
Majors of brigade, incamped together - - - -	—	—	—	1	—	—	2
Judge advocate - - -	—	—	—	1	—	—	7
Provoſt-marſhal - -	—	—	—	1	—	—	18
Provoſt-marſhal, when he has priſoners - -	—	1	—	2	1	1	48

HOOKS, thoſe which are fixed to the tranſom plates of a field-carriage: they ſerve to fix the drag-ropes for drawing it occaſionally backwards and forwards.

HOOPS, of iron, of ſeveral ſorts, ſuch as nave and axle-tree hoops.

HORIZONTAL *Superficies*, is the plain field lying upon a level, without any riſing or falling.

HORIZONTAL *Range*. See RANGE.

HORN-*Work*. See FORTIFICATION.

HORSE-*Shoe*. See FORTIFICATION.

HORSE, in a *military ſenſe*. }
A body of HORSE. - - } See CAVALRY.

HOSPITAL, a place appointed for the ſick and wounded men, provided with a number of phyſicians, ſurgeons, nurſes, ſervants, medicines, beds, &c.

Camp-Hoſpitals, are either general or regimental. The general hoſpitals are of two kinds, viz.

Flying-Hospital.
Stationary-Hospital. } The firſt attends the camp at ſome convenient diſtance, and the latter is fixed at one place. In the choice of both Dr. Pringle thinks it better to have them in towns than villages, as the former will afford larger wards, beſides more of other conveniences. Theſe wards ſhould be as airy as poſſible.

Regimental-Hoſpitals, are frequently in barns, ſtables, granaries, and other out-houſes; but above all, churches make the beſt hoſpitals from the beginning of June to October: theſe hoſpitals are ſolely for the uſe of the regiment they belong to.

Hospital-*Fever*, a name given to the malignant catarrhal fever, as being moſt frequent in hoſpitals.

HOSTAGE, a perſon given up to an enemy as a ſecurity for the performance of the articles of a treaty.

HOSTILITY, denotes a ſtate of war or enmity between two nations. During a truce all acts of hoſtility are to ceaſe on both ſides.

HOUSING, or ſaddle-houſing, cloth, ſkin, or other ornament added to ſaddles, by way of diſtinction; frequently embroidered with gold or ſilver, or edged with gold or ſilver lace.

HOWITZ, a kind of mortar, mounted upon a field-carriage like a gun: the difference between a mortar and a howitz is, that the trunnions of the firſt are at the end, and in the middle in the laſt. The invention of howitzes is of much later date than mortars, for they really had their origin from them.

The conſtructions of howitzes are as various and uncertain as thoſe of mortars, excepting the chambers, which are all cylindric. They are diſtinguiſhed by the diameter of the bore; for inſtance, a 10-inch howitz is that, the diameter of which is 10 inches; and ſo of the ſmaller ones.

Dimenſions of Howitzes. Plate XIII. fig. 6.

	Inch.	Inch.
Diameter of the bore —	10.	8.
From the muzzle to the reinforce	19.4	16.
Length of the reinforce —	11.9	10.7
Total length of the howitz	50.4	37.4
Length of the bore	29.2	25.9
chamber	16.8	9.9
Its greateſt diameter	6.5	4,6
Its leaſt	5.6	4.
Breadth of the muzzle-ring	1.7	1.25
From the muzzle-ring to the aſtragal	4.3	4.6
Breadth of the aſtragal —	1.3	.7
Of the ogee before the reinforce	2.	1.4
behind	1.7	0
Of the aſtragal — —	1.4	.7
Of the baſe ring — —	1.8	1.25
From the baſe-ring to the aſtragal	2.2	0
Breadth of the aſtragal	1.3	0
Thickneſs of the metal at the muz.	2.75	2.25
At the muzzle-ring —	5.	3.4
Near the reinforce —	3.4	2.6
At the reinforce —	5.0	3.4
Behind the reinforce —	4.4	2.5
Diameter of the baſe ring	20.	14.7
vent aſtragal	17.5	12.5
caſcable	8.25	7.6
button	7.	3.
neck	5.	3.5
Breadth of the ogee and fillets	1.	.9
Of the ſecond ogee and fillets	1.6	.9
Diameter of the firſt fillet	11.13	9:5
ſecond	7.64	4.5
Length and diameter of the trunnion	6.	4.4
From the reinforce to the trunnion	2.	1.2
Chamber contains powder	lb. 18	lb. 4
Weight of the howitz	C. 31 2 26	12 1 11

Howitz-*Carriage*. See Carriage.

HUNTERS. See Horse.

HURDLES, in *fortification*, are made of twigs of willows or oſiers, interwoven cloſe together, ſuſtained by long ſtakes. They are made in the figure of a long ſquare; the length being 5 or 6 feet, and breadth 3 or 3½. The cloſer they are wattled together, the better. They ſerve to render batteries firm, or to conſolidate the paſſage over muddy ditches; or to cover traverſes and lodgements for the defence of the workmen againſt the fire-works, or the ſtones, that may be thrown againſt them.

HURTERS, a flatted iron fixed againſt the body of an axle-tree, with ſtraps to take off the friction of the naves of wheels againſt the body.

Hurter. See Battery.

HUSSARS, are the national cavalry of Hungary and Croatia. Their regimentals conſiſt in a rough furred cap, adorned with a cock's feather (the officers, either an eagle's or a heron's), a doublet, with a pair of breeches, to which the ſtockings are faſtened, and yellow or red boots; beſides they occaſionally wear a ſhort upper waiſtcoat, edged with furs, and 5 rows of round metal buttons, and in bad weather a cloak. Their arms are, a ſabre, carbine, and piſtols. They are irregular troops: hence, before beginning an attack, they lay themſelves ſo flat on the necks of their horſes, that it is hardly poſſible to diſcover their force; but being come within piſtol-ſhot of the enemy, they raiſe themſelves with ſuch ſurpriſing quickneſs, and begin the fight with ſuch vivacity on every ſide, that unleſs the enemy is accuſtomed to their method of engaging, it is very difficult for troops to preſerve their order. When a retreat is neceſſary, their horſes have ſo much fire, and are ſo indefatigable, their equipage ſo light, and themſelves ſuch excellent horſemen, that no other cavalry can pretend to follow them: they leap over ditches, and ſwim over rivers, with ſurpriſing facility. They never incamp, conſequently are not burthened with any kind of camp-equipage, ſaving a kettle and a hatchet to every 6 men. They always lie in the woods, out-houſes, or villages, in the front of the army. The Emperor, queen of Hungary, and the king of Pruſſia, have the moſt troops under this name in their ſervice.

J I

JACK. See GIN.

JAMES, or *Knights of St. James*, a military order in Spain, firſt inſtituted in the year 1170, by Ferdinand II. king of Leon and Galicia. The greateſt dignity belonging to this order is grand-maſter, which has been united to the crown of Spain. The knights are obliged to make proof of their deſcent from families that have been noble for 4 generations, on both ſides: they muſt alſo make it appear that their ſaid anceſtors have neither been Jews, Saracens, nor heretics; nor have ever been called in queſtion by the Inquiſition. The novices are obliged to ſerve 6 months in the galleys, and to live a month in a monaſtery. They obſerve the rules of St. Auſtin, making no vows but of poverty, obedience, and conjugal fidelity.

JANIZARIES, an order of the Turkiſh infantry, reputed the Grand Signior's guards, and the main ſtrength of the Ottoman army: they are all infantry, and were firſt formed of captive Chriſtians by the emperor Amurath I. Their number is generally above 40,000, divided into 162 companies, or chambers, called *odas*, in which they live together at Conſtantinople, as in a convent. The Janizaries are of a ſuperior rank to all other ſoldiers: they are alſo more arrogant and factious; and it is by them the public tranquillity is moſtly diſturbed. The government may therefore be ſaid to be entirely in the hands of Janizaries. They have however ſome good qualities: they are employed to eſcort travellers, and eſpecially ambaſſadors, and perſons of high rank, on the road; in which caſe they behave with the utmoſt zeal and fidelity.

JAVELIN, in *military antiquity*, a ſort of ſpear 5½ feet long; the ſhaft of which was of wood, with a ſteel point. Every ſoldier in the Roman armies had 7 of theſe, which were very light and ſlender.

ICHNOGRAPHY, in *fortification*, denotes the plan or repreſentation of the length and breadth of a fortification, the diſtinct parts of which are marked out, either on the ground itſelf, or on paper: by this we are at once acquainted with the value of the different lines and angles.

IMPETUS, in *mechanics*, the force with which one body impels or ſtrikes another. See GUNNERY, MOMENTUM.

INCH, a well-known meaſure in length, being the 12th part of a foot, and equal to 3 barley-corns in length. See MEASURE.

INCLINED *Plane*. See GUNNERY.

INCAMPMENT, the lodging of an army in the field, according to its ſeveral quarters, which are to lie conveniently for water, wood, and forage, &c. See CAMP.

INCAMP. *To incamp*, is the pitching of tents, when the army after a march is arrived at a place where it is deſigned to halt a night, or longer. See CAMP.

INDENTED *Line*, in *fortification*, is a line running out and in, like the teeth of a ſaw, forming ſeveral angles; ſo that one ſide defends another. They are uſed on the banks of rivers, where they enter a town; likewiſe the parapet of the covert-way is often indented. This is by the French engineers called *Redans*. Small places are ſometimes fortified with ſuch a line; but the fault of ſuch fortifications is, that the beſiegers from one battery may ruin both ſides of the tenaille of the front of a place, and make an aſſault; without fear of being enfiladed, ſince the defences are ruined.

INDEPENDENT *Company*, } is what is not
INDEPENDENT *Troop*, } incorporated into any regiment.

INFANTRY, means the whole body of foot ſoldiers, whether independent companies, or regiments. The origin of the word is taken from one of the Infantas of Spain, who, finding that the army commanded by the king her father, had been defeated by the Moors, aſſembled a body of foot ſoldiers, and with them engaged and totally routed the enemy. In honour of this event, and to diſtinguiſh the foot ſoldiers, who were not before held in much conſideration, they received the name of infantry.

Heavy-armed INFANTRY, amongſt *the ancients*, were ſuch as wore a complete ſuit of armour, and engaged with broad ſhields and long ſpears. They were the flower and ſtrength of the Grecian armies, and had the higheſt rank of military honour.

Light-armed INFANTRY, amongſt *the ancients*, were deſigned for ſkirmiſhes, and for fighting at a diſtance. Their weapons were arrows, darts, or ſlings.

Light-INFANTRY have only been in uſe ſince the year 1656. They have no camp-equipage to carry, and their arms and accoutrements are much lighter than the infantry. Among the troops of this country is not found any light infantry, though they are the eyes of a general, and the givers of ſleep and ſafety to an army. Wherever there is found light-cavalry, there ſhould be light-infantry. They ſhould be accuſtomed to the pace of 4 miles an hour, as their uſual marching pace, and to be able to march at 5 miles an hour, upon all particular occaſions. Moſt of the powers on the continent have light-infantry.

INFIRMARY. See HOSPITAL.

INGINEER. See ENGINEER.

INSCONSED, in the *military art*. Part of an army that have fortified themſelves with a ſconce or ſmall work, in order to defend ſome paſs, &c. are ſaid to be *inſconſed*.

INSULT, in the *art of war*. See ASSAULT.

INTERIOR *ſide of a fortification*, is an imaginary line drawn from the centre of one baſtion to that of the next; or rather the curtain produced to the centres of the baſtions.

INTERVALS, in the *art of war*, the ſpaces left between each regiment in camp, as likewiſe between each tent. See CAMP.

Intervals, though they never exceed the length of a battalion or ſquadron, are ſometimes leſs, according to the views of a commander; ſo that there is no general rule in forming them.

INTRENCHMENT, any work that fortifies a poſt againſt an enemy that attacks. It is generally taken for a ditch or trench with a parapet. *Intrenchments* are ſometimes made of faſcines, with earth thrown over them, of gabions, hogſheads, or bags filled with earth, to cover the men from the enemy's fire. See RETRENCHMENT.

INVALID, is a ſoldier who has ſpent his time in war, and the army; and is, either through age, or by reaſon of his wounds, rendered incapable of the ſervice. We have 20 independent companies of invalids, diſperſed in the ſeveral forts and garriſons; and thoſe that are incapable of any ſervice, are diſpoſed of in hoſpitals.

INVASION, in *war*, the entrance or attack of an enemy on the dominions of another.

JOINT-*Bolts*. See BOLTS.

IRON-*Guns*. See GUNS.

IRON, for marking with a broad R the horſes that are taken for the government's ſervice to draw the artillery, ammunition, and ſtores, &c.

IRONS. See PRIMING-IRONS.

INVESTING *a place*, is when a general, having an intention to beſiege it, detaches a body of horſe to poſſeſs all the avenues; blocking up the garriſon, and preventing relief from getting into the place, 'till the army and artillery are got up to form the ſiege.

JUST, a ſportive combat on horſeback, man againſt man, armed with lances.

K

KEEP, in *ancient military hiſtory*, a kind of ſtrong tower in the middle of a caſtle or fort, wherein the beſieged made their laſt efforts of defence.

KETTLE, to boil compoſition for fireworks.

KETTLE-*Drums*. See DRUMS.

KETTLE-*Drum-Cart*, belonging to the royal artillery only, is a four-wheel carriage, drawn by 4 horſes. On the fore part ſtands the ordnance-flag, and on the hind ſits the drum-major, with 2 kettle-drums, as in a chair of ſtate. This cart is finely engraven and gilt. It has not been in the field ſince the year 1743, when his majeſty was preſent. It is kept in the tower.

KEYS, in *artillery carriages*, are of different ſorts:

Fore-lock-Keys, ſerve to paſs through the lower end of bolts, to faſten them.

Spring-Keys, ſerve the ſame purpoſes as the other; but, inſtead of being of one ſingle piece, they are of two, like two ſprings laid one over the other: when they are put into eye-bolts, they are pinched together at the ends, and when they are in, open again: hence they cannot ſhake out by the motion of the carriages. They are uſed in travelling-carriages.

Keys, with chains and ſtaples fixed on the ſide-pieces of a carriage or mortar-bed: they ſerve to faſten the cap-ſquares, by paſſing through the eyes of the eye-bolts.

KLINKETS, in *fortification*, are a ſort of ſmall gates made through palliſades, for ſallies.

KNAPSACK, in a *military ſenſe*, a rough leather-bag, which a ſoldier carries on his back, and which contains all his neceſſaries. Square knapſacks are moſt convenient, and ſhould be made with a diviſion to hold the ſhoes, black-ball and bruſhes, ſeparate from the linen. White goat-ſkins are the beſt.

KNIGHT, a perſon who, on account of ſome martial feat, or notable action, is by the king raiſed to a rank above a gentleman. The original German and Dutch word *knecht*, or *knebt*, ſignifies a ſervant, as we find it ſtill meant by the knight of the ſhire; and afterwards it denoted a military man, or rather horſeman, as being uſually employed on horſeback. In our common law they are called *milites*, as commonly holding lands by knights ſervice, to ſerve the king in his wars.

L

LABARUM, in the *ancient art of war*, the ſtandard born before the Roman emperors; being a rich purple ſtreamer, ſupported by a ſpear.

LABORATORY, ſignifies that place where all ſorts of fire-works are prepared, both for actual ſervice, and for pleaſure, viz. quick-matches, fuzes, portfires, grape-ſhot, caſe-ſhot, carcaſſes, hand-grenades, cartridges, ſhells filled, and fuzes fixed, wads, &c. &c.

Aigrettes. See Mortars.

Balls are of various ſorts, ſhapes and forms; as

Chain-ſhot, in *military matters*, are two ſhot linked together by a ſtrong chain of 8 or 10 inches long: they are more uſed on board men of war, than in the land ſervice. The famous M. de Witt was the firſt inventor, about the year 1665.

Light-balls, of which there are ſeveral ſorts: the beſt compoſition is mealed powder 2, ſulphur 1, roſin 1, turpentine 2½, and ſaltpetre 1½. Then take tow, and mix and dip it in this compoſition, 'till of a proper ſize, letting the laſt coat be of mealed powder. Or take thick ſtrong paper, and make a ſhell the ſize of the mortar you intend to throw it out of, and fill it with a compoſition of an equal quantity of ſulphur, pitch, roſin, and mealed powder; which being well mixed, and put in warm, will give a clear fire, and burn a conſiderable time.

When they are intended to ſet fire to magazines, &c. make them as follows, viz. *Pl. XIV. fig.* 9. Set off with a radius of ½ the calibre of the mortar, the circle *ABCD*, dividing the ſame into 4 equal parts: out of *B*, and with the radius *AB*, deſcribe the arc *AE*; and from *A*, with the radius *AB*, deſcribe the arc *BE*; and from *E*, with the radius *EA*, the arc *AB*: now 8 ſuch pieces, as *ABE*, cut out of dimitty, &c. and ſewed together, will make, when filled, a ball exactly round. N. B. A ſmall hole muſt be left to fill them by. The compoſition for filling them is, mealed powder 10, ſaltpetre 2, ſulphur 4, and roſin 1; or mealed powder 4, pounded glaſs 1, antimony ½, camphire ½, ſal-ammoniac 1, common ſalt ¼; or mealed powder 48, ſaltpetre 32, ſulphur 16, roſin 4, ſteel or iron filings 2, fir-tree ſaw-duſt boiled in ſaltpetre leye 2, and birch-wood charcoal 1. With any of theſe compoſitions fill the ſack, and ram it, if poſſible, as hard as a ſtone, putting in the opening a fuze, and about the ſame an iron ring 1-5th of the ball's diameter wide, and on the oppoſite end, another ring 1-6th of the ball's diameter; then with a ſtrong cord of 1-4th of an inch diameter, lace round the hoops, or rings, from one end of the ball to the other, as often as requiſite; this is called the ribbed-coat: then lace it again the contrary way, which is called the check-coat.

Between each ſquare cord, iron barrels are drove in, 1-3d of which are filled with powder, and a bullet: at the end of each a ſmall vent is made, that the compoſition may inflame the powder, and drive the balls out on every ſide, which not only kill numbers of people, but prevent any one from extinguiſhing the fire-ball. The whole muſt, when finiſhed, be dipped in melted pitch, roſin, and turpentine oil; which faſtens the whole together.

Smoke-balls, are made and contrived to give an uncommon ſmoke, and thereby prevent the enemy from ſeeing what you are about. They are prepared as above, only the compoſition muſt be 5 to 1 of pitch, roſin, and ſaw-duſt: the ingredients are put into iron ſhells, having 4 holes each to let out the ſmoke, and are thrown out of mortars.

Experiments with SMOKE-BALLS, *in iron-ſhells*, 1762.

Nature of Mort.	Shells wt.		powder		eleva·		Len. of pr.		time of ſmoke		range	Remarks.
	emp.	full					fuze	p.fire				
	lb.	lb.	lb.	oz.	°	'	inch.	inch.	'	"	feet	
13	183	203	2	12	45		1½	1½	27		1668	They all gave a good ſmoke in general.
13	187	200½	2	10	45		1½	1½	26	30	1678	
13	185	216	2	8	40		1½	1½	23	15	1438	
13	190	208	1	2	40	30	1½	1½	24		976	
10	78	97	1	4	45		1½	1½	26		1350	
10	76	98	1	5	45		1½	1½	30		1396	
10	80	93	1	6	45		1½	1½	28	30	1399	
10	79	96½	1	7	36	30	1½	1½	36		1413	

N. B. *The Powder was in flannel cartridges.*

Stink-
Poiſoned-
Red-hot-
Chain-
Stang-
Anchor-
} *Balls.* See BALLS.

Meſſage-Balls. See SHELLS.

Fire-Barrels, are at preſent not much uſed: they were of different ſorts; ſome mounted on two wheels. The inſide of the barrel is loaded with powder, and the outſide full of ſharp iron points, intermixed with grenades loaded, and fuzes fixed. Sometimes they are placed under ground, and made uſe of to annoy the enemy's approach.

Carcaſs, in *military affairs*, was formerly of an oval form, made of iron bars, and filled with a compoſition of mealed-powder, ſaltpetre, ſulphur, broken glaſs, ſhavings of horn, pitch, turpentine, tallow, and linſeed-oil, covered with a pitched cloth: it is primed with mealed powder and quick-match, and fired out of a mortar. Its deſign is to ſet houſes on fire, &c. See CARCASS at letter C.

Experiments with ROUND CARCASSES *at an elevation of* 45°.

Mortars	Weight of the carcaſs		Quantity of powder		Flight	Time of burning		Length of priming	Range	Remarks
	lb.	oz.	lb.	oz.	"	'	"	inch.	feet	
10	62	13		8	6	3		$2\frac{7}{10}$	390	Burnt well in general. Fired from 7 to 9, in the morning. Good light.
0	64	12		12	8	3	12	$2\frac{7}{10}$	774	
10	70		1		10	3	40	$2\frac{7}{10}$	882	
10	71	12	1	4	11½	4		$2\frac{7}{10}$	1332	Fired from 2 to 4 in the morning, very dark. Gave a very good light.
10	72		1	12	13	4	18	$2\frac{7}{10}$	1815	
10	68	10	2		14	4	45	$2\frac{7}{10}$	2043	
8	33	7		6	6	3	4	$2\frac{7}{10}$	411	Fired from 10 to 2 in the night. Had a very good effect.
8	36	12		10	8	3	20	$2\frac{7}{10}$	963	
8	35	8		14	12	5		$2\frac{7}{10}$	1344	
8	34	14	1		14	3	40	$2\frac{7}{10}$	1680	
8	32	12	1	4	13	5	10	$2\frac{7}{10}$	1908	

None but *round carcaſſes* are uſed at preſent, the flight of the oblong ones are ſo uncertain. The compoſition is, pitch 2, ſaltpetre 4, ſulphur 1, and corned powder 3. When the pitch is melted, the pot is taken off, and the ingredients (well mixed) put in; then the carcaſs is filled with as much as can be preſſed in.

Experiments with 13-*inch round* IRON CARCASSES, *with* 4 *holes; fired out of a* 13-*inch ſea-ſervice-mortar, at Woolwich, in* 1773.

Empty			Full			Powder		Elevation		Range	Remarks
c.	qr.	lb.	c.	qr.	lb.	lb.	oz.	deg.	m.	feet	
1	2	27	1	3	12	30		45		8700	One ſmall piece burſt from the carcaſs, and fell at 4500 feet diſtance; the other piece contained the compoſition. The two laſt did not break.
1	3	1	1	3	14	30		41		9000	
1	3	3	1	3	16	30		42		10200	
1	1	4	1	3	17	30		42	30	10500	

Cartridges, in *military matters*, are made of various ſubſtances, ſuch as paper, parchment, bladders, and flannel. When they are made of paper, the bottoms remain in the piece, and accumulate ſo much, that the priming cannot reach the powder; beſides other inconveniences. When they are made of parchment or bladders, the fire ſhrivels them up, ſo that they enter into the vent, and become ſo hard, that the priming-iron cannot remove them ſo as to clear the vent. Nothing has been found hitherto to anſwer better than flannel, which is the only thing uſed at preſent for artillery cartridges of all ſorts, becauſe it does not keep fire, and is therefore not liable to accidents in the loading; but, as the duſt of powder paſſes through them, a parchment cover is ſometimes made to put over them, which is taken off when uſed.

The beſt way of making flannel cartridges, is to boil the flannel in ſize; which will prevent the duſt of powder from paſſing through them, and render them ſtiff, and more manageable; for without this precaution they are ſo pliable, when large, and contain much powder, that they are put into the piece with much difficulty.

The loading and firing guns with cartridges is done much ſooner, and leſs liable to accidents, than with looſe powder.

In quick firing the ſhot is fixed to the cartridge by means of a wooden bottom, hollowed on one ſide ſo as to receive nearly half the ſhot, which is faſtened to it by 2 ſmall ſlips of tin croſſing over the ſhot, and nailed to the bottom; and the cartridge is tied to the other end thereof. They are fixed likewiſe in the ſame manner to the bottoms of grape-ſhot, which are uſed in field-pieces.

Fuzes, in *artillery*, are chiefly made of very dry beech-wood, and ſometimes of horn-beam, taken near the root. They are turned rough, and bored at firſt, and then kept for ſeveral years in a dry place: the diameter of the hole is about 1-4th of an inch: the hole does not go quite through, leaving about 1-4th of an inch at the bottom; and the head is made hollow in the form of a bowl.

The compoſition for fuzes is ſaltpetre 3, ſulphur 1, and mealed powder, 3, 4, and ſometimes 5. This compoſition is drove in with an iron driver, whoſe ends are capped with copper to prevent the compoſition from taking fire; and equally hard as poſſible; the laſt ſhovelfull being all mealed powder, and two ſtands of quickmatch laid acroſs each other, being drove in with it, the ends of which are folded up into the hollow top, and a cap of parchment tied over it 'till uſed.

When theſe fuzes are drove into the loaded ſhell, the lower end is cut off in a ſlope, ſo that the compoſition may inflame the powder in the ſhell: the fuze muſt have ſuch a length as to continue burning all the time the ſhell is in its range, and to ſet fire to the powder as ſoon as it touches the ground, which inſtantly burſts into many pieces. When the diſtance of the battery from the object is known, the time of the ſhell's flight may be computed to a ſecond or two; which being known, the fuze may be cut accordingly, by burning 2 or 3, and making uſe of a watch or a ſtring by way of a pendulum to vibrate ſeconds. See Table of Loaded-ſhells Experiments.

Table of FUZES, *containing the greateſt ranges correſponding to a given time of flight, and the length of fuze, allowing* 4, 4½, *or* 5 *ſeconds to each inch of fuze.*

Time in ſeconds	Fuze in inches			Range in yards	Time in ſeconds	Fuze in inches			Range in yards	Time in ſeconds	Fuze in inches			Range in yards
	4	4.5	5			4	4.5	5			4	4.5	5	
1	0.25	0.22	0.20	5	5¼	1.31	1.17	1.05	148	9½	2.38	2.11	1.90	485
¼	0.31	0.28	0.25	8	½	1.38	1.22	1.10	162	¾	2.44	2.17	1.95	510
½	0.38	0.33	0.30	12	¾	1.44	1.28	1.15	178	10	2.50	2.22	2.00	537
¾	0.44	0.40	0.35	16	6	1.50	1.33	1.20	193	¼	2.56	2.28	2.05	564
2	0.50	0.44	0.40	21	¼	1.56	1.40	1.25	210	½	2.60	2.33	2.10	592
¼	0.56	0.50	0.45	27	½	1.63	1.44	1.30	227	¾	2.69	2.40	2.15	621
½	0.62	0.55	0.50	34	¾	1.69	1.50	1.35	245	11	2.75	2.44	2.20	650
¾	0.69	0.61	0.55	41	7	1.75	1.56	1.40	263	¼	2.81	2.50	2.25	680
3	0.75	0.66	0.60	48	¼	1.81	1.61	1.45	282	½	2.88	2.56	2.30	710
¼	0.81	0.72	0.65	57	½	1.88	1.67	1.50	302	¾	2.94	2.61	2.35	741
½	0.88	0.78	0.70	66	¾	1.94	1.72	1.55	323	12	3.00	2.67	2.40	773
¾	0.94	0.83	0.75	76	8	2.00	1.78	1.60	344	¼	3.06	2.72	2.45	806
4	1.00	0.90	0.80	86	¼	2.06	1.83	1.65	365	½	3.13	2.78	2.50	839
¼	1.06	0.94	0.85	97	½	2.13	1.89	1.70	388	¾	3.19	2.83	2.55	873
½	1.13	1.00	0.90	109	¾	2.19	1.95	1.75	411	13	3.25	2.89	2.60	908
¾	1.19	1.06	0.95	121	9	2.25	2.00	1.80	435	¼	3.31	2.95	2.65	943
5	1.25	1.11	1.00	134		2.31	2.06	1.85	459	½	3.38	3.00	2.70	979

Conti-

Continuation of the TABLE.

Time in ſeconds	Fuze in inches			Range in yards	Time in ſeconds	Fuze in inches			Range in yards	Time in ſeconds	Fuze in inches			Range in yards
	4	4.5	5			4	.5	5			4	4.5	5	
13¾	3.44	3.06	2.75	1015	20¼	5.06	4.50	4.05	2208	26¾	6.69	5.95	5.35	3843
14	3.50	3.11	2.80	1053	½	5.13	4.56	4.10	2257	27	6.75	6.00	5.40	1315
¼	3.56	3.17	2.85	1090	¾	5.19	4.61	4.15	2311	¼	6.81	6.06	5.45	3988
½	3.63	3.22	2.90	1129	21	5.25	4.67	4.20	2368	½	6.88	6.11	5.50	4061
¾	3.69	3.28	2.95	1168	¼	5.31	4.71	4.25	2425	¾	6.94	6.17	5.55	4135
15	3.75	3.33	3.00	1208	½	5.38	4.78	4.30	2482	28	7.00	6.22	5.60	4210
¼	3.81	3.40	3.05	1249	¾	5.44	4.83	4.35	2540	¼	7.06	6.28	5.65	4286
½	3.88	3.44	3.10	1290	22	5.50	4.89	4.40	2599	½	7.13	6.33	5.70	4362
¾	3.94	3.50	3.15	1332	¼	5.56	4.95	4.45	2658	¾	7.19	6.40	5.75	4439
16	4.00	3.56	3.20	13 5	½	5.63	5.00	4.50	2719	29	7.25	6.44	5.80	4516
¼	4.06	3.61	3.25	1418	¾	5.69	5.06	4.55	2779	¼	7.31	6.50	5.85	4594
½	4.13	3.67	3.30	1462	23	5.75	.11	4.60	2841	½	7.38	6.56	5.90	4673
	4.19	3.72	3.35	1507	¼	5.81	5.17	4.65	2903	¾	7.44	6.61	.95	4753
17	4.25	3.78	3.40	1552	½	5.88	5.22	4.70	2966	30	7.50	6.67	6.00	4833
¼	4.31	3.83	3.45	1598	¾	5.94	5.28	4.75	3029	¼	7.56	6.72	6.05	4914
½	4.38	3.89	3.50	1645	24	6.00	5.33	4.80	3093	½	7.63	6.78	6.10	49 5
¾	4.44	3.95	3.55	1692	¼	6.06	5.40	4.85	3158	¾	7.69	6.83	6.15	5078
18	4.50	4.00	3.60	1740	½	6.13	5.44	4.90	3223	31	7.75	6.89	6.20	5161
¼	4.56	4.06	3.65	1789	¾	6.19	5.50	4.95	3289	¼	7.81	6.95	6.25	5244
½	4.63	4.11	3.70	1838	25	6.25	5.56	5.00	3356	½	7.88	7.00	6.30	5328
¾	4.69	4.1	3.75	1888	¼	6.31	5.61	5.05	3424	¾	7.94	7.06	6.35	5413
19	4.75	4.22	3.80	1939	½	6.38	5.67	5.10	3492	32	8.00	7.11	6.40	5499
¼	4.81	4.28	3.85	1990	¾	6.44	5.72	5.15	3561	¼	8.06	7.17	6.45	5585
½	4.88	4.33	3.90	2040	26	6.50	5.78	5.20	3630	½	8.13	7.22	6.50	5662
¾	4.94	4.40	3.95	2095	¼	6.56	5.83	5.25	3700	¾	8.19	7.28	6.55	5760
20	5.00	4.44	4.00	2148	½	6.63	5.89	5.30	3771					

N. B. The uſe of this table is obvious from inſpection only. The uſe of the following table is to know the proper length of fuzes for all the different mortars, and their compoſitions for any propoſed range; and, as fuzes burn equal lengths in equal times, hence the following rule. For inſtance, the range of an 8-inch ſhell is ordered to be 1206 yards: Quære, the length of the fuze. Say, As 32 ſeconds is to 7 inches, ſo is 15 ſeconds to 3.28 inches, the fuze's length required.

Second TABLE *of* FUZES.

Nat. of mortar	Total length of fuze		Diam. of fuze at neck		Diam. at the end		Diam. at the cap.		Length of compoſit.		Time of burning		Diam. of compoſit.		Diam. of fuze-holes	
inch.	in.	pts.	in.	pts.	in.	pts.	in.	pts.	in.	pts.	″	‴	in.	pts.	in.	pts.
13	10	5	2	2	1	47	2	5	8		35			58	1	7 1/16
10	9	36	1	65	1	5	1	86	7	5	33			51	1	5/8
8	8	5	1	6	1	1	1	86	7		32	5		42	1	3/16
roy.	4	5	1	2		86	1	3	3	75	22			25		
coh.	4		1			6	1	1	3	¼	19	10		25		

Grape-ſhot, in *artillery*, is a combination of ſmall ſhot, put into a thick canvas bag, and corded ſtrongly together, ſo as to form a kind of cylinder, whoſe diameter is equal to that of the ball which is adapted to the cannon.

To make grape-ſhot, a bag of coarſe cloth is made juſt to hold the bottom which is put into it; then as many ſhot as the grape is to contain; and with a ſtrong pack-thread they are quilted to keep the ſhot from moving; and, when finiſhed, they are put into boxes for carriage, to be tranſported wherever it is neceſſary.

The number of ſhot in a grape varies according to the ſervice or ſize of the guns: in ſea-ſervice 9 is always the number; but by land it is increaſed to any number or ſize, from an ounce and a quarter in weight, to 4 pounds. It has not yet been determined, with any degree of accuracy, what number and ſize anſwers beſt in practice; for it is well known, that they often ſcatter ſo much, that only a ſmall number take place. See PRACTICE.

Experiments with land GRAPE-SHOT, *of* 34 *balls for a* 6-*pounder*, 28 *for a* 3-*pounder*, *and* 20 *for a* 1½-*pounder*, *againſt a canvaſs* 12 *feet ſquare*, *the centre* 6 *feet from the ground*, *in* 1768.

Nat. pdrs.	Powder lb.	Powder oz.	Line of metal feet	Diſt. feet	Shot thro'	Remarks
6	1		2½ under cent.	600	8	Grazed at a great diſtance.
	1	8	2½ ditto	ditto	3	Reſt cloſe, a good grape.
	2		9 in. ditto	750	2	Spread round the object.
	2	8	2 under ditto	900	.	Grazed before the object.
	3		3 under ditto	ditto	3	Very good grape. Some ſhort.
3		8	centre	600		Grazed from 15 to 20 feet ſhort.
		12	ditto	680	6	Spread well.
		14	ditto	678	5	Spread well.
1½		6	2 feet over	750	2	Spread too high.
		6	centre	900	3	Ditto.

In this and the following table the columns are eaſily underſtood. By *greateſt effect*, in the following table, is meant the effect of the beſt round in four, which were fired each at 30 minutes difference of elevation, beginning at 0 degrees; and that effect (or number through the curtain) is expreſſed in decimal parts of the whole charge of grape; i. e. .33 means 33 hundredth parts of 9 lb. 4 oz. = 3.3 lb. nearly: ſo that if each experiment were ſufficiently purſued, theſe numbers would exhibit the comparative powers or fitneſs of each different kind of piece for grape-ſhot, &c.

Ordnance						Weight of powder		Weight of grape		Greateſt effect at 200 yards.		Greateſt effect at 300 yards	
calib.	length		weight			lb.	oz.	lb.	oz.	proportional parts.	weight of grape thro' lb.	proportional parts.	weight of grape thro' lb.
	F.	In.	c.	qr.	lb.								
heavy 6-pdr.	8	0	18	3	13	4	8	9	14	.31	3.4	.33	3.3
						3	0	5	8	.31	1.6	.23	1.2
						2	0	9	14			.22	2.
						2	0	5	8			.29	1.6
light 6-pdr.	4	6	5	1	15	2	0	9	14	.34	3.4	.29	2.9
						1	8	5	8	.39	2.1	.38	2.
3-pdr.	3	6	2	2	19	1	0	5	0	.42	2.	.30	1.5
						0	12	5	0	.62	1.8	.40	1.2
8-in. how.	chaſe 2	1½	11	3	0	2	0	38	4	.55	20.	.27	10.
5½ dit.	1	6	4	1	10	1	0	13	8	.27	3.6	.22	3.

Hence, it is to be obſerved, that of the 3 different ſorts of cannon uſed in theſe experiments, the 3-pounder ſeems rather the beſt, proportionally; that is, it throws the largeſt ſhare through the curtain; often its half-charge at that diſtance: ſo that the effect of two 3-pounders is much greater than that of one 6-pounder. But the 8-inch howitzer, which can be made to throw in from 3 to 5 of its charge (from 12 to 20 lb. of ſhot) becomes thereby a very formidable piece, when it can be uſed for grape-ſhot.

Proper charges for grape-ſhot have never yet been effectually determined: we can only give our advice from ſome experiments; that for heavy 6-pounders 1-3d of the weight of the ſhot appears to be the beſt charge of powder; for the light 6-pounders, 1-4th of the weight of the ſhot; and for howitzers, 1-8th or 1-10th anſwers very well.

This kind of fire ſeems not yet to have been enough reſpected, nor depended on. However, if cannon and howitzers can be made to throw 1-3d or 1-4th, and ſometimes ½ their charge of grape-ſhot into a ſpace 39 × 12 feet, at 200 and 300 yards diſtance, and thoſe fired 10 or 12 times in a minute; it ſurely forms the thickeſt fire that can be produced from the ſame ſpace.

Tin-caſe-ſhot, in *artillery*, is formed by putting a great quantity of ſmall iron ſhot into a cylindrical tin-box, called a caniſter, that juſt fits the bore of the gun. Leaden bullets are ſometimes uſed in the ſame manner; and it muſt be obſerved, that whatever number or ſizes of the ſhots are uſed, they muſt weigh, with their caſes, nearly as much as the ſhot of the piece.

Caſe-ſhot, formerly, conſiſted of all kinds of old iron, ſtones, muſket-balls, nails, &c. and uſed as above.

TABLE *of* TIN-CASE-SHOT.

Nature of pounders	Shot		Wt. of tin caſe	Length of caſe	Length fixed	Diam. of ſhot	Weight finiſhed		Number in one pound
	Wt.	N°.							
	oz.	N°.	oz.	inch.	inch.	in. pts.	lb.	oz.	
42	6	94	15½	8¾	1¼	1.526	39	2½	2
32	6	72	15	8¼	1	1.030	27	2	2½
24 G	6¾	48	13½	8	1	1.410	21	12½	2⅔
24 F	4	84	13½	8	1	1.211	21	13½	4
18	4¾	38	9½	7¾	1	1.410	17	3½	2⅔
12 G	2	43	7½	6¼	⅞	1.211	10	12½	4
12 F	1½	107	7½	6½	⅞	.961	10	8½	11⅖
9	2	73	5½	6	$\frac{6}{10}$	1.001	8	12½	$5\frac{4}{16}$
9 G	3	27	4¼	5	$\frac{6}{10}$	1.000	5	5½	$5\frac{4}{16}$
6 F	1¼	56	4¼	5	$\frac{6}{10}$	.762	5	3	12
3	1⅛	34	2¼	4	$\frac{5}{10}$	.953	2	9⅝	14¼
1½	1⅛	17	1¾	$3\frac{9}{10}$	$\frac{5}{10}$	.953	1	5⅝	14¼
5½ H	6	70	8¼	$4\frac{2}{10}$	1	.961	9	4½	12
7¾ H	6¾	72	14	$6\frac{2}{10}$	1	1.410	32	6	2⅔

Explanation.—G ſtands for garriſon-pieces, F for field-pieces, and H for howitzers.

Tubes, in *artillery*, are made uſe of in quick firing. They are made of tin: their diameter is 2-10ths of an inch, being juſt ſufficient to enter into the vent of the piece; about 6 inches long, with a cap above, and cut ſlanting below, in the form of a pen: the point is ſtrengthened with ſome ſolder, that it may pierce the cartridge without bending. Through this tube is drawn a quick-match, the cap being fitted with mealed powder, moiſtened with ſpirits of wine. To prevent the mealed powder from falling out by carriage, a cap of paper or flannel, ſteeped in ſpirits of wine, is tied over it.

Fire-ſhip, a veſſel filled with combuſtible materials, and fitted with grappling-irons to hook, and ſet fire to the enemy's ſhips in battle, &c.

From the bulk-head at the forecaſtle to a bulk-head to be raiſed behind the main chains, on each ſide and acroſs the ſhip at the bulk-heads, is fixed, cloſe to the ſhip-ſides, a double row of troughs, 2 feet diſtance from each other, with croſs troughs quite round, at about 2½ diſtance; which are mortiſed into the others. The croſs troughs lead to the ſides of the ſhip, to the barrels, and to the port-holes, to give fire both to the barrels and to the chambers, to blow open the ports; and the ſide-troughs ſerve to communicate the fire all along the ſhip and the croſs troughs.

The timbers of which the troughs are made, are about 5 inches ſquare; the depth of the troughs, half their thickneſs; and they are ſupported by croſs pieces at every 2 or 3 yards, nailed to the timbers of the ſhip, and to the wood-work which incloſes the fore and main maſts. The decks and troughs are all well paved with melted roſin.

On each ſide of the ſhip 6 ſmall port-holes are cut, from 15 to 18 inches large, the ports opening downwards, and are cloſe caulked up. Againſt each port is fixed an iron chamber, which, at the time of firing the ſhip, blows open the ports, and lets out the fire. At the main and fore chains, on each ſide, a wooden funnel is fixed over a fire-barrel, and comes through a ſcuttle in the deck, up to the ſhrouds, to ſet them on fire. Both funnels and ſcuttles muſt be ſtopped with plugs, and have ſail-cloth or canvaſs nailed cloſe over them, to prevent any accident happening that way, by fire, to the combuſtibles below.

The port-holes, funnels, and ſcuttles, not only ſerve to give the fire a free paſſage to the outſide and upper parts of the ſhip, and her rigging, but alſo for the inward air (otherwiſe confined) to expand itſelf, and puſh through thoſe holes at the time of the combuſtibles being on fire, and prevent the blowing up the decks, which otherwiſe muſt of courſe happen, from ſuch a ſudden and violent rarefaction of the air as will then be produced.

In the bulk-head behind, on each ſide, is cut a ſmall hole, large enough to receive a trough of the ſame ſize of the others; from which, to each ſide of the ſhip, lies a leading trough, one end coming through a ſally-port cut through the ſhip's ſide, and the other fixing into a communicating trough that lies along the bulk-head, from one ſide of the ſhip to the other; and being laid with quick-match, at the time of firing either of the leading troughs, communicates the fire in an inſtant to the contrary ſide of the ſhip, and both ſides burn together.

Fire-barrels, for a fire-ſhip, are cylindric, on account of that make anſwering better both for filling them with reeds, and for ſtowing them between the troughs: their inſide diameters are about 21 inches, and their length 33. The bottom parts are firſt filled with double-dipt reeds ſet on end, and the remainder with fire-barrel compoſition, which is, corned powder 30 lb. Swediſh pitch 12, ſaltpetre 6, and tallow 3, well mixed and melted, and then poured over them.

There are 5 holes of ¾ inches diameter, and 3 inches deep, made with a drift of that ſize in the top of the compoſition while it is warm; one in the centre, and the other four at equal diſtances round the ſides of the barrel. When the compoſition is cold and hard, the barrel is primed by well driving thoſe holes full of fuze compoſition, to within an inch of the top; then fixing in each hole a ſtrand of quick-match twice doubled, and in the centre-hole two ſtrands the whole length; all which muſt be well drove in with mealed powder: then lay the quick-match all within the barrel, and cover the top of it with a dipt curtain, faſtened on with a hoop to ſlip over the head, and nailed on.

Bavins, for a fire-ſhip, are made of birch, heath, or other ſort of bruſh-wood, that is both quickly fired, and tough: in length 2.5, or 3 feet; the buſh-ends all laid one way, and the other ends tied with two bands each. They are dipped and ſprinkled with ſulphur the ſame as reeds, only that the buſh-ends alone are dipped, and ſhould be a little cloſed together by hand, as ſoon as done, to keep them more cloſe, in order to give a ſtronger fire, and to keep the branches from breaking in ſhifting and handling them. Their compoſition is, roſin 120 lb. coarſe ſulphur 90, pitch 60, tallow 6, and mealed powder 12; with ſome fine ſulphur for ſalting.

Iron-chambers, for a fire-ſhip, are 10 inches long, and 3.5 in diameter; breeched againſt a piece of wood fixed acroſs the port-holes. When loaded, they are almoſt filled full of corned powder, with a wooden tompion well drove into their muzzles. They are primed with a ſmall piece of quick-match thruſt through their vents into the powder, with a part of it hanging out; and when the ſhip is fired, they blow open the ports, which either fall downwards, or are carried away, and ſo give vent to the fire out of the ſides of the ſhip.

Curtains, for a fire-ſhip, are made of barras, about ¾ of a yard wide, and 1 yard in length: when they are dipped, 2 men, with each a fork, muſt run the prongs through the corner of the curtain at the ſame end; then dip them into a large kettle of compoſition (which is the ſame as the compoſition for bavins) well melted; and when well dipped, and the curtain extended to its full breadth, whip it between 2 ſticks of about 5.5 feet long, and 1.5 inches ſquare, held cloſe by 2 other men to take off the ſuperfluous compoſition hanging to it; then immediately ſprinkle ſaw-duſt on both ſides to prevent its ſticking, and the curtain is finiſhed.

Reeds, for a fire-ſhip, are made up in ſmall bundles of about 12 inches in circumference, cut even at both ends, and tied with two bands each: the longeſt ſort is 4 feet, and the ſhorteſt 2.5; which are all the lengths which are uſed. One part of them are ſingle-dipped, only at one end; the reſt are double-dipped, i. e. at both ends. In dipping, they muſt be put about 7 or 8 inches deep into a copper kettle of melted compoſition (the ſame as that for bavins); and when drained a little over it, to carry off the ſuperfluous compoſition, ſprinkle them over a tanned hide with pulveriſed ſulphur, at ſome diſtance from the copper.

Stores *for a* Fire-ship *of* 150 *tons.*

	Number.	Value.		
Fire-barrels	8	£.80	0	0
Iron chambers	12	£.12	0	0
Priming compoſition barrels	3½	21	0	0
Quickmatch barrels	1	3	0	0
Curtains dipped	30	3	0	0
Long reeds ſingle dipped	150	10	15	0
Short reeds double dipped	75	2	18	9
Short reeds ſingle dipped	75	1	17	6
Bavins ſingle dipped	209	10	0	0
		£.144	11	3

Quantity of Composition *for preparing the ſtores of a* Fire-ship.

	Petre	Sulphur	Corned Powder	Pitch	Roſin	Tallow	Tar	Oil-pots
For 8 barrels			960	480		80		
For 3 barrels of priming compoſition	175	140	350		21			11
For curtains, bavins, reeds, and ſulphur to ſalt them		200		350	175	50	25	
Total	175	340	1310	830	196	130	25	11

Total weight of the compoſition 3107 pounds, equal to C. 26: 3: 2.

Compoſition allowed for the reeds and barrels, $\frac{1}{5}$ of the whole of the laſt article, which is equal to 160 lb. making in the whole 3177 pounds, or C. 28: 1: 13.

Port-fires, in *artillery*, may be made any length: however, they are ſeldom made more than 21 inches. The interior diameter of port-fire moulds ſhould be $\frac{10}{16}$ of an inch, and the diameter of the whole port-fire about ½ an inch. The paper caſes muſt be rolled wet with paſte, and one end folded down. They are uſed inſtead of matches to fire artillery. The compoſition of wet port-fires is, ſalt-petre 6, ſulphur 2, and mealed powder 1; when it is well mixed and ſieved, it is to be moiſtened with a little linſeed oil: the compoſition for dry port-fire is, ſalt-petre 4, ſulphur 1, mealed powder 2, and antimony 1.

Rockets, in *pyrotechny*, an artificial firework, conſiſting of a cylindrical caſe of paper, filled with a compoſition of certain combuſtible ingredients; which, being tied to a ſtick, mounts into the air to a conſiderable height, and there burſts: they are frequently uſed as ſignals in war time.

Compoſition for ſky-rockets in general is, ſalt-petre 4 lb. brimſtone 1 lb. and charcoal 1½ lb: but for large ſky-rockets, ſalt-petre 4 lb. meal-powder 1 lb. and brimſtone 1 lb: for rockets of a middling ſize, ſalt-petre 3 lb. ſulphur 2 lb. meal-powder 1 lb. and charcoal 1 lb.

Quick-match, in *artillery*, is of 2 ſorts, cotton and worſted: the firſt is generally made of ſuch cotton as is put in candles, of ſeveral ſizes, from 1 to 6 threads thick, according to the pipes it is deſigned for. The ingredients are, cotton 1 lb. 12 oz. ſalt-petre 1 lb. 8 oz. ſpirits of wine 2 quarts, water 2 quarts, iſinglaſs 3 gills, and meal powder 10 lb: it is then taken out hot, and laid in a trough where ſome mealed powder, moiſtened with ſpirits of wine, is thoroughly wrought into the cotton. This done, they are taken out ſeparately, and drawn through mealed powder, and hung upon a line to dry.—The compoſition for the ſecond is, worſted 10 oz. mealed powder 10 lb. ſpirits of wine 3 pints, and white-wine vinegar 3 pints.

Scaling-LADDERS, are uſed in ſcaling when a place is to be taken by ſurpriſe. They are made ſeveral ways: here, we make them of flat ſtaves, ſo as they may move about their pins, and ſhut like a parallel ruler, for conveniently carrying them: the French make them of ſeveral pieces, ſo as to be joined together, and to be made of any neceſſary length: ſometimes they are made of ſingle ropes, knotted at proper diſtances, with iron hooks at each end, one to faſten them upon the wall above, and the other in the ground; and ſometimes they are made with 2 ropes, and ſtaves between them, to keep the ropes at a proper diſtance, and to tread upon. When they are uſed in the action of ſcaling walls, they ought to be rather too long than too ſhort, and to be given in charge only to the ſtouteſt of the detachment. The ſoldiers ſhould carry theſe ladders with the left arm paſſed through the ſecond ſtep, taking care to hold them upright cloſe to their ſides, and very ſhort below, to prevent any accident in leaping into the ditch.

The firſt rank of each diviſion, provided with ladders, ſhould ſet out with the reſt at the ſignal, marching reſolutely with their firelocks ſlung, to jump into the ditch: when they are arrived, they ſhould apply their ladders againſt the parapet, obſerving to place them towards the ſalient angles rather than the middle of the curtain, becauſe the enemy have leſs force there. Care muſt be taken to place the ladders within a foot of each other, and not to give them too much nor too little ſlope, ſo that they may not be overturned or broke with the weight of the ſoldiers mounting upon them.

The ladders being applied, they who have carried them, and they who come after, ſhould mount up, and ruſh upon the enemy ſword in hand: if he who goes firſt, happens to be overturned, the next ſhould take care not to be thrown down by his comrade; but, on the contrary, immediately mount himſelf, ſo as not to give the enemy time to load his piece.

As the ſoldiers who mount firſt may be eaſily tumbled over, and their fall may cauſe the attack to fail, it would perhaps be right to protect their breaſts with the fore-parts of cuiraſſes; becauſe, if they can penetrate, the reſt may eaſily follow.

The ſucceſs of an attack by ſcaling is infallible, if they mount the 4 ſides at once, and take care to ſhower a number of grenades amongſt the enemy, eſpecially when ſupported by ſome grenadiers and picquets, who ſhare the attention and fire of the enemy.

LADLES, in *gunnery*, are made of copper, to hold the powder for loading of guns, with long handles of wood, when cartridges are not uſed.

Ladles, in *laboratory buſineſs*, are very ſmall, made of copper, with ſhort handles of wood, uſed in filling the fuzes of ſhells, or any other compoſition, to fill the caſes of ſky-rockets, &c.

LANCE, or *javelin*, a ſort of weapon, much uſed of old.

To Lance, to throw a lance.

LANE, in a *military ſenſe*, is where men are drawn up in two ranks facing one another, as in a ſtreet, for any great perſon to paſs through; or ſometimes for a ſoldier to run the gantlope.

LANS-PESATE, LANCE-PESATE, in ſome of the *foreign troops*, is a ſoldier that does duty as a corporal, eſpecially on guards and detachments.

LANTERN, LANTHORN, commonly called Muſcovy lanterns, being a kind of dark-lanterns, uſed in the field, when dark, to light the gunners in the camp to prepare the ſtores, &c.

LASING-RINGS, LASHING-RINGS, in *artillery*, with hoops, fixed on the ſide-pieces of travelling carriages, to laſh the tarpauling, as alſo to tie the ſponge, rammer, and ladle. See Carriage.

LATH, in *building*, a long, thin, and narrow ſlip of wood, nailed to the rafters of a roof or cieling, in order to faſten the covering. They are diſtinguiſhed into three kinds, according to the different kinds of wood of which they are made, viz. heart of oak, ſap-laths, deal-laths, &c.

LATITUDE, in *geography*, the diſtance of any place from the equator, meaſured in degrees, minutes, ſeconds, &c. upon the meridian of that place; and is either north or ſouth, according as the place is ſituated either on the north or ſouth ſide of the equator. See Geography.

LAW *of arms*, is a law which gives precepts how to proclaim a war, to attack the enemy, and to puniſh offenders in the camp.

Military-Law. See Courts-Martial.

Law *of marque*, or *letters of marque*, that by which perſons take the goods or ſhipping of the party that has wronged them, as in time of war, whenever they can take them within their precincts.

LAZARUS, LAZARO, a military order inſtituted at Jeruſalem by the Chriſtians of the Weſt, when maſters of the holy land, who received pilgrims under their care, and guarded them on the roads from the inſults of the Mahometans. This order was inſtituted in the year 1119, and confirmed by a bull of pope

Alexander IV. in 1255, who gave it the rule of St. Auguſtine.

LEAD, a metal well known: it is employed for various mechanic uſes; as in thin ſheets for covering buildings, for pipes, pumps, ſhot, bullets, windows, for ſecuring iron bars in hard ſtones, for ſundry kinds of large veſſels for evaporation, and many other mechanic purpoſes. See BALLS.

LEAGUE, in *military hiſtory*, a meaſure of length, containing more or leſs geometrical paces, according to the different uſages and cuſtoms of countries. A league at ſea, where it is chiefly uſed by us, being a land-meaſure moſtly peculiar to the French and Germans, contains 3000 geometrical paces, or 3 Engliſh miles.

The French league ſometimes contains the ſame meaſure, and, in ſome parts of France, it conſiſts of 3500 paces: the mean or common league conſiſts of 2400 paces, and the little league of 2000. The Spaniſh leagues are larger than the French, 17 Spaniſh leagues making a degree, or 20 French leagues, or 69 and ½ Engliſh ſtatute miles. The German and Dutch leagues contain each 4 geographical miles. The Perſian leagues are pretty near of the ſame extent with the Spaniſh; that is, they are equal to 4 Italian miles, which is pretty near to what Herodotus calls the length of the Perſian paraſang, which contained 30 ſtadia, 8 whereof, according to Strabo, make a mile.

LEAGUE, alſo denotes an alliance or confederacy between princes and ſtates for their mutual aid, either in attacking ſome common enemy, or in defending themſelves.

LEGATUS, in *Roman antiquity*, a military officer who commanded as deputy of the chief general.

LEGION, in *Roman antiquity*, a body of foot which conſiſted of ten cohorts.

The exact number contained in a legion, was fixed by Romulus at 3000; though Plutarch aſſures us, that, after the reception of the Sabines into Rome, he increaſed it to 6000. The common number afterwards, in the firſt times of the free ſtate, was 4000; but, in the war with Hanibal, it roſe to 5000; and after that, it is probable that it ſunk again to 4200, which was the number in the time of Polybius.

LETTER *of mart*, }
LETTER *of marque*, } a letter granted to one of the king's ſubjects, under the privy-ſeal, impowering him to make repriſals for what was formerly taken from him by the ſubjects of another ſtate, contrary to the law of mart. See MARQUE.

LETTER *of mart*, a commiſſion granted by the lords of the admiralty, or by the vice-admiral of any diſtant province, to the commander of a merchant ſhip, or privateer, to cruiſe againſt, and make prizes of the enemy's ſhips and veſſels, either at ſea, or in their harbours.

LEVEL, an inſtrument to draw a line parallel to the horizon, whereby the difference of aſcent or deſcent between ſeveral places may be found, for conveying water, draining fens, &c.

Air-LEVEL, that which ſhows the line of level by means of a bubble of air, incloſed with ſome liquor in a glaſs tube of an indeterminate length and thickneſs, whoſe two ends are hermetically ſealed. When the bubble fixes itſelf at a certain mark, made exactly in the centre of the tube, the plane or ruler wherein it is fixed is level: when it is not level, the bubble will riſe to one end. This glaſs tube may be ſet in another of braſs, having an aperture in the middle, whence the bubble of air may be obſerved. There is one of theſe inſtruments with ſights, being an improvement upon the laſt deſcribed, which, by the addition of more apparatus, becomes more commodious and exact: it conſiſts of an air-level about 8 inches long, and 7 or 8 lines in diameter, ſet in a braſs tube, with an aperture in the middle: the tubes are carried in a ſtrong ſtraight ruler, a foot long, at whoſe ends are fixed two ſights, exactly perpendicular to the tubes, and of an equal height, having a ſquare hole, formed by two fillets of braſs croſſing each other at right angles, in the middle whereof is drilled a very little hole, through which, a point on a level with the inſtrument is deſcribed: the braſs tube is faſtened on the ruler by means of two ſcrews, one whereof ſerves to raiſe or depreſs the tube at pleaſure, for bringing towards a level. The top of the ball and ſocket is riveted to a little ruler that ſprings, one end whereof is faſtened with ſcrews to the great ruler, and at the other end is a ſcrew ſerving to raiſe and depreſs the inſtrument when nearly level.

Artillery foot-LEVEL, is in form of a ſquare, having its two branches or legs of an equal length, at the angle of which is a ſmall hole, whence hangs a line and plummet, playing on a perpendicular line in the middle of a quadrant: it is divided into twice 45 degrees from the middle. (Pl. XII. fig. 5.)

Gunner's-LEVEL, for levelling pieces of artillery, conſiſts of a triangular braſs plate, about 4 inches, at the bottom of which is a portion of a circle divided into 45 degrees; which angle is ſufficient for the higheſt elevation of cannons, mortars, and howitzers, and for giving ſhot and ſhells the greateſt range: on the centre of this ſegment of a circle is ſcrewed a piece of braſs, by means of which it may be fixed or ſcrewed at pleaſure; the end of this piece of braſs is made ſo as to ſerve for a plummet and index, in order to ſhow the different degrees of elevation of pieces of artillery. This inſtrument has alſo a braſs foot, to ſet upon cannon or mortars, ſo that when theſe pieces are horizontal, the inſtrument will be perpendicular. The foot of this inſtrument is to be placed on the piece to be elevated, in ſuch a manner, as that the point of the plummet may fall on the proper degree, &c. (Fig. 6.)

The moſt curious inſtrument for the uſe of the artilleriſt, was lately invented by the very ingenious Capt. Congreve, of the royal artillery; having the following qualifications, viz. 1. It will find the inclination of any plane, whether above or below the horizon. 2. By applying it either to the cylinder, or outſide, of any piece of ordnance, angles of elevation or depreſſion may be given to the 60th part of a degree, with leſs trouble than the common gunner's quadrant, which only gives to the 4th part of a degree. 3. It will give the line of direction for laying either guns or mortars to an object above or below the horizon. 4. It will find the centre of metal of any piece of ordnance. 5. With it, a point may be found in the rear of a mortar-bed, in the vertical plane of the mortar's axis; conſequently a longer line of ſight is given for directing them to the object than the uſual way. 6. It anſwers all the purpoſes of a pair of callipers, with the advantage of knowing (to the 100th part of an inch) diameters whether concave or convex, without the trouble of laying the claws upon a diagonal ſcale. 7. On the ſides of the inſtrument are the following lines, viz. equal parts, ſolids, plains and polygons, logarithms, tangents, verſed ſines, ſines and numbers, plotting ſcales, and diagonal ſcale of inches for cutting fuzes by. 8. In the lid of the inſtrument-caſe is a pendulum to vibrate half-ſeconds. It is likewiſe of ſingular uſe in ſurveying; as, 1. It takes horizontal angles to the 60th part of a degree. 2 Vertical angles. 3. Levels. 4. Solves right-angled plane triangles. 5. Oblique-angled plane triangles. 6. Anſwers all the purpoſes of a protractor, with the advantage of laying down angles exactly as taken in the field. N. B. Capt. Jordane's ingenious inſtrument anſwers nearly the ſame purpoſes.

LEVELLING, the finding a line parallel to the horizon at one or more ſtations, and ſo to determine the height of one place in regard to another.

A truely level ſurface is a ſegment of any ſpherical ſurface, which is concentric to the globe of the earth. A true line of level is an arch of a great circle which is imagined to be deſcribed upon a truely level ſurface.

The apparent level is a ſtraight line drawn tangent to an arch or line of a true level. Every point of the apparent level, except the point of contact, is higher than the true level: thus (Plate VI. fig. 1.) let *E A G* be an arch of a great circle drawn upon the earth: to a perſon who ſtands upon the earth at *A*, the line *H D* is the apparent level, parallel to his rational horizon *R R*; but this line, the further it is extended from its ſtation *A*, the further it recedes from the centre; for *B C* is longer than *A C*, and *D C* is longer than *B C*, &c.

The common methods of levelling are ſufficient for laying pavements of walks, for conveying water to ſmall diſtances, for placing horizontal dials, or aſtronomical inſtruments; but in levelling the bottoms of canals or ditches in a fortification, which are to convey water to the diſtance of many miles, the difference between the apparent and true level muſt be taken into the account: thus (fig. 2.) let *I A L* be an arch of a great circle upon the earth; let it be required to cut a canal, whoſe bottom ſhall be a true level from *A* to *B*, of the length of 5078 feet. The common method is, to place the levelling inſtrument in the bottom of the canal at *A*, and looking through the ſights placed horizontally at a ſtick ſet up perpendicular at *B*, to make a mark where the viſual ray or line of the apparent level points at *E*, and then to ſink the bottom of the canal at *B*, as much below *E* as *A* is below *D*: but this will not give us a true level; for, according to Caſſini's calculation, at the diſtance of 5078 feet, the apparent level is 7 inches above the true; and therefore, to make a true level, *B* muſt be ſunk 7 inches lower than the apparent level directs; ſo that, if *A* be 4 feet below *D*, *B* muſt be 4 feet 7 inches below the mark *E*. We have here mentioned the error which will ariſe from placing the level at one end of the line to be levelled, and ſhown how to correct it; but, in moſt caſes, it is better to make a ſtation in the middle of the line to be levelled: thus, if the points *H* and *B* are to be levelled, place the inſtrument in the middle at *A*, and, ſetting up ſticks perpendicular at *H* and *B*, make marks upon each ſtick where the apparent level points, as *E* and *F*: thoſe points are level; and, if you ſink *H* as much below *F* as *B* is below *E*, *H A B* will be a true level. When the bottom of a canal is thus truely level, if water be let in at one end, it will riſe to the ſame height at the other. If water be required to run with any velocity, that is of another conſideration: a river will run, though very ſlowly, which hath not 6 inches deſcent below the true level for a mile in length. If a river whoſe water is foul, be required to run with ſuch a velocity as to carry its foulneſs into the ſea, 16 inches, or at leaſt 1 foot, fall below the true level, in a mile running, have been thought ſufficient by perſons ſkilled in that affair.

This we thought neceſſary to premiſe before we explained the method uſed in levelling, which is as follows. Suppoſe the height of the point *A* (Plate VI. fig. 3.) on the top of a mountain, above that of the point *B* at the foot thereof, be required; place the level about the middle diſtance, between the two points, as in *D*, and ſtaves in *A* and *B*; and let there be perſons inſtructed with ſignals for raiſing and lowering on the ſtaves little marks of paſteboard, or any ſuch matter: the level being placed horizontally, &c. look towards the ſtaff *A E*, and cauſe the mark to be raiſed or lowered, till the middle, upper edge, or other moſt conſpicuous part, appear in the viſual ray; then meaſuring exactly the perpendicular height of the point *E* above *A*, which ſuppoſe 8 feet 6 inches, ſet that down in your book; then turn the level horizontally about, that the eye-glaſs of the teleſcope may be ſtill next the eye, when you look the other way, (if you have only plain ſights, the inſtrument need not be turned) and cauſe the perſon at the ſtaff *B* to raiſe or lower the mark till ſome conſpicuous part fall in the viſual ray, as at *C*: then meaſure the perpendicular of *C* above *B*, which ſuppoſe 20 feet 8 inches; ſet this alſo down in the book above the other numbers: ſubtract the one from the other; the remainder will be 12 feet 2 inches, which is the difference of level between *A* and *B*, or the height of the point *A* above *B*.

If the point *D*, where the inſtrument is fixed, be in the middle between *A* and *B*, there will be no neceſſity for reducing the apparent level to the true, the viſual ray being then equally raiſed above the true level.

If it be farther required to know whether there be a ſufficient deſcent for conveying water from the ſpring *A* to the point *B* (fig. 4.) here, as the diſtance from *A* to *B* is conſiderable, it is requiſite that ſeveral operations be made. Having then choſen a proper place for the firſt ſtation, as at *I*, ſet up a ſtaff in the point *A*, near the ſpring, with a proper mark to ſlide up and down the ſtaff, as *L*; and meaſure the diſtance from *A* to *I*, which ſuppoſe 2000 yards. Then the level being adjuſted in the point *K*, let the mark *L* be raiſed and lowered till you eſpy ſome conſpicuous part through the teleſcope, or ſights, and meaſure the height *A L*, which ſuppoſe 13 feet 5 inches. But in regard to the diſtance *A I*, which is 2000 yards, you muſt have recourſe to your table for reduction, ſubtracting 11 inches, which will leave the height *A L* 12 feet 6 inches; and this note down in your book. Now turn the level horizontally, ſo as the eye-glaſs of the teleſcope may be towards the ſtaff at *A*, and fixed upon another ſtaff at *H*: cauſe the mark *G* to be moved up and down, till you can eſpy ſome conſpicuous part: meaſure the height *H G*, which ſuppoſe 6 yards 4 feet 2 inches: meaſure likewiſe the diſtance of the points *I H*, which ſuppoſe 1300 yards; for which diſtance, 4 inches 8 lines muſt be ſubtracted from the height *H G*, which will leave but 6 yards, 3 feet, 9 inches, 4 lines, to be taken down in your book. This done, remove the level forwards to *E*, whence the ſtaff *H* may be viewed, as alſo another ſtaff at *D*; and proceed in every reſpect as before.

When a proper ſtation for the level has been pitched upon between the two points, the two heights obſerved at that ſtation muſt be written down in two columns; namely, under the firſt column, thoſe obſerved when the eye was from the ſpring or towards the point, which may be called back-ſights; and under the ſecond column, thoſe obſerved when the eye was next the ſpring, or the fore-ſights.

Having ſummed up the height of each column ſeparately, ſubtract the leſſer from the greater, and the remainder will be the difference of level between *A* and *B*.

If the diſtance of the two points be required, add all the diſtances meaſured together; and, dividing the difference of height by the yards of the diſtances, for each 200 yards you will have a deſcent of about 2 inches 9 lines.

Dr. Halley ſuggeſts a new method of levelling, which is performed wholly by the barometer, in which the mercury is found to be ſuſpended to ſo much the leſs height, as the place is more remote from the centre of the earth. Hence it follows, that the different height of the mercury in two places gives the difference of level.

Mr. Derham, from ſome obſervations at the top and bottom of the monument in London, found that the mercury fell 1-10th of an inch at every 82 feet of perpendicular aſcent, when the mercury was at 30 inches. Dr. Halley allows of 1-10th of an inch for every 30 yards; and, conſidering how accurately barometers are now made, we think this method ſufficiently exact to take levels for the conveyance of water, or any other military purpoſes, and indeed leſs liable to errors than the common levels. Mr. Derham alſo found a difference of 3 inches 8-10ths between the height of the mercury at the top and bottom of Snowdon-hill, in Wales.

For the common occaſions of levelling, ſet a pole upright in a ſpring, pond, &c. and mark how many feet and inches are above water; then ſet up another pole of equal length with the other, in the place to which the water is to come. Place the centre of a quadrant on the top of this laſt pole, the plummet hanging free; ſpy through the ſights the top of the pole in the water, and if the thread cuts any degree of the quadrant, the water may be conveyed by a pipe laid in the earth. If you cannot ſee from one extreme to the other, the operation may be repeated.

LEVELLING *ſtaves*, inſtruments uſed in levelling, that carry the marks to be obſerved, and at the ſame time meaſure the heights of thoſe marks from the ground. Theſe uſually conſiſt of 2 wooden ſquare rulers, that ſlide over one another, and are divided into feet, inches, &c.

LEVER, in *mechanics*, an inflective line, rod, or beam, moveable about, or upon a fixed point, called the prop or fulcrum, upon one end of which is the weight to be raiſed; at the other end is the power applied to raiſe it, as the hand, &c.

Since the momentum of the weight and power are as the quantities of matter in each, multiplied by their reſpective celerities; and the celerities are as the diſtances from the centre of motion, and alſo as the paces paſſed through in a perpendicular direction in the ſame time; it muſt follow, that there will be an equilibrium between the weight and power, when they are to each other reciprocally as the diſtances from the centre, or as the celerities of the motions, or as the perpendicular aſcent or deſcent in the ſame time; and this univerſally in all mechanical powers whatſoever, and which is therefore the fundamental principle of all mechanics. See MECHANICAL POWERS.

LIEUTENANT, is the ſecond commiſſioned officer in every company of both foot and horſe, and next to the captain, and who takes the command upon the death or abſence of the captain.

LIEUTENANT *of artillery*. Each company of artillery has 4; 1 firſt and 3 ſecond lieutenants. The firſt lieutenant has the ſame detail of duty with the captain, becauſe in his abſence he commands the company: he is to ſee that the ſoldiers are clean and neat; that their clothes, arms, and accoutrements, are in good and ſerviceable order; and to watch over every thing elſe, which may contribute to their health. He muſt give attention to their being taught their exerciſe, ſee them punctually paid, their meſſes regularly kept, and to viſit them in the hoſpitals when ſick. He muſt aſſiſt at all parades, &c. He ought to underſtand the doctrine of projectiles and the ſcience of artillery, with the various effects of gunpowder, however managed or directed; to enable him to conſtruct and diſpoſe his batteries to the beſt advantage; to plant his cannon, mortars, and howitzers, ſo as to produce the greateſt annoyance to an enemy. He is to be well ſkilled in the attack and defence of fortified places, and to be converſant in arithmetic, mathematics, and mechanics, &c.

Second LIEUTENANT, in the *artillery*, is the ſame as an enſign in an infantry regiment, being the youngeſt commiſſioned officer in the company, and muſt aſſiſt the firſt lieutenant in the detail of the company's duty. His other qualifications ſhould be equal with thoſe of the firſt lieutenant.

LIEUTENANT { *of engineers*. See ENGINEER.
colonel. See COLONEL.
general. See GENERAL.

LIEUTENANT *de roy*, the deputy-governor of all ſtrong towns in France, who is a check upon the governor, and commands in his abſence.

LIEUTENANT *reformed*, he whoſe company or troop is broke or diſbanded, but continued in whole or half pay, and ſtill preſerves his right of ſeniority and rank in the army.

LIFE-GUARDS. See GUARDS.

LIGHT-HORSE. See CAVALRY.

LIMBER, in *artillery*, a two-wheel carriage with ſhafts to faſten the trail of travelling-carriages by means of a pintle or iron pin, when travelling, and taken off on the battery, or when placed in the park of artillery; which is called unlimbering the guns. See CARRIAGE.

LIME, in *military architecture*, is made of all kind of ſtones, that will calcine: that which is made of the hardeſt ſtones is the beſt, and the worſt of all, that which is made of chalk.

Different counties in England produce different kinds of lime-ſtones. In Kent, abounding with chalk-pits, the lime is very bad. There are ſome rocks near Portſmouth, that make exceeding good lime. The beſt lime in England is that made of the marble in the neighbourhood of Plymouth. Before the ſtones are thrown into the kiln, they are to be broken into ſmall pieces, otherwiſe the air contained in their cavities, being too much expanded by heat, makes them fly with ſo much violence as to damage the kilns. Lime will not be ſufficiently burnt in leſs than 60 hours. The marks of well-burnt lime are, that its weight is to that of the ſtone in a ſeſquialterate proportion; that it be white, light, and ſonorous; that when ſlaked, it ſticks to the ſides of the veſſel, ſending forth a copious thick ſmoke, and requires a great deal of water to ſlake it.

In ſome foreign parts they make good lime of all ſorts of ſhells of ſea-fiſh, which dries and hardens in a very ſhort time; and when it is mixed with Dutch terras, is very fit for all kinds of aquatic works.

Lime ſhould always be burnt with coals, and never with wood, the coals being ſtrongly impregnated with ſulphureous particles, which, mixed with the lime, make it more glutinous. See MORTAR.

LIMITS, in a *military ſenſe*, is that diſtance which a centry is allowed on his poſt, namely, 50 paces to the right, and as many to the left; and though the weather be ever ſo bad, he muſt not get under cover.

LINCH-*pin*, in *artillery*, that which paſſes through the ends of the arms of an axle-tree, to keep the wheels or trucks from ſlipping off in travelling. See CARRIAGE.

LINCH-*clout*, in *artillery*, the flat iron under the ends of the arms of an axle-tree, to ſtrengthen them, and to diminiſh the friction of the wheels. See CARRIAGE.

LINE, in *geometry*, a quantity extended in length only, without any breadth or thickneſs. It is formed by the flux or motion of a point.

There are two kinds of lines, viz. right lines and curve lines. Right lines are all thoſe which go the neareſt way to any given point. Curve lines are uſually divided into geometrical and mechanical: the former are thoſe which may be found exactly in all their points; the latter are thoſe, ſome or all of whoſe points are not to be found preciſely, but only tentatively, or nearly ſo.

Lines, conſidered as to their poſitions, are either parallel, perpendicular, or oblique, &c. Euclid's ſecond book treats moſtly of lines, and of the effects of their being divided, and again multiplied into one another.

LINE *of battle*, is the drawing up of an army for an engagement, extending its front as far as the ground will allow, that it may not be flanked. The Turkiſh armies often draw up in a curve line or half-moon, that, being very numerous, they may incloſe the enemy. Chriſtian armies generally form, or draw up, in 3 lines; the firſt called the *front*, the ſecond the *centre*, and the third the *rear*; with a convenient diſtance between them, and intervals, ſo as not to put each other in confuſion. See BATTLE.

LINES, in *fortification*, bear ſeveral names and ſignifications; ſuch as,

LINE *of*
defence
defence fichant
defence razant
circumvallation
countervallation
counter-approach
defence prolonged
Capital LINE - - -
See *Fortification.*

LINES *of communication*, are trenches that unite one work to another, ſo that men may paſs between them without being expoſed to the enemy's fire: thence the whole intrenchment round any place is ſometimes called a *line of communication*, becauſe it leads to all the works.

Inſide LINES, are a kind of ditches towards the place, to prevent ſallies, &c.

Outſide LINES, are a kind of ditches towards the field, to hinder relief, &c.

To LINE, in a *military ſenſe*, is nothing more than to environ a rampart, parapet, or ditch, &c. with a wall of maſonry or earth.

To LINE *hedges*, &c. to plant troops, artillery, or ſmall arms, along them under their cover, to fire upon an enemy that advances openly, or to defend them from the horſe, &c.

To break the LINE, to change the direction from that of a ſtraight line, in order to obtain a croſs-fire.

LINES, in a *military ſenſe*, a name given to all kinds of works made by an army from one town or ſtrong poſt to another, behind which it is encamped, to guard a part of the country, &c.

If an army is ſo weak as to be within *lines*, you take care to have communications between the villages, and ſmall parties of light-horſe patroling towards the enemy, and to have videts and centries poſted ſo near one another, that you may have intelligence of all their tranſactions.

Turning out of the Line, in a *military ſenſe.* The line turns out without arms whenever the general commanding in chief, comes along the front of the camp.

When the *lines* turn out, the private men are drawn up in a line with the bells-of-arms; the corporals on the right and left of their reſpective companies: the picquet forms behind the colours, with their accoutrements on, but without arms.

The ſerjeants draw up one pace in the front of the men, dividing themſelves equally.

The officers draw up in ranks, according to their commiſſions, in the front of the colours; two enſigns taking hold of the colours.

The field-officers advance before the captains.

The camp-colours on the flanks of the parade are to be ſtruck, and planted oppoſite to the bells-of-arms; the officers eſpontoons are to be planted between the colours, and the drums piled up behind them; the halberts are to be planted between, and on each ſide the bells-of-arms, and the hatchets turned from the colours.

Line *of direction*, in *gunnery*, is a line formerly marked upon guns, by a ſhort point upon the muzzle, and a cavity on the baſe-ring, to direct the eye in pointing the gun; but is at preſent moſtly left off.

Line of { *leaſt reſiſtance*, in *mining*. See Mining.
march. See March.
diſtance, the interval between two things, either in regard to time, place, or quantity. }

Line *of gravitation*, of any heavy body, is a line drawn through its centre of gravity, and according to which it tends downwards.

Line *of ſwifteſt deſcent*, of a heavy body, is the cycloid. See Cycloid.

Line { *of projectile*. See Projectiles.
in *fencing*, that part of the body oppoſite to the enemy, wherein the ſhoulders, the right arm, and the ſword, ſhould always be found; and wherein are alſo to be placed the two feet at the diſtance of 18 inches from each other. In which ſenſe, a man is ſaid to be in his line, or to go out of his line, &c. }

Line, alſo denotes a French meaſure, containing 1-12th part of an inch. It is of late frequently made uſe of in our calculations. See Fencing.

LINKS, in the *art of war*, are diſtinct reins, or thongs of leather, uſed by the cavalry to link their horſes together, when they diſmount, that they may not diſperſe. Every tenth man is generally left to take care of them.

LINS-*pins*. See Linch-Pins.

LINT-*ſtock*, in *gunnery*, a ſtick uſed by the gunners to faſten the match, which always keeps burning in time of action, ready to light the port-fires.

LIST, in a *military ſenſe*, incloſed ground in which combats are fought.

To enter the Lists, is to contend with a perſon.

To List *ſoldiers*, } to retain and enroll as ſol-
To inliſt, } diers, either as volunteers, or by a kind of compulſion.

LISTING. Perſons liſted, to be carried within four days, but not ſooner than 24 hours after, before the next juſtice of peace of any county, riding, city, or place, or chief magiſtrate of any city or town-corporate (not being an officer in the army); and if, before ſuch juſtice or magiſtrate, they diſſent from ſuch inliſting, and return the inliſting-money, and alſo 20 ſhillings in lieu of all charges expended on them, they are to be diſcharged.

But ſuch perſons, refuſing or neglecting to return and pay ſuch money within 24 hours, ſhall be deemed as duly liſted, as if they had aſſented thereto before the proper magiſtrate; and they ſhall, in that caſe, be obliged to take the oath, or, upon refuſal, they ſhall be confined by the officer who liſted them, 'till they do take it.

Perſons, owning before the proper magiſtrate, that they voluntarily liſted themſelves, are obliged to take the oath, or ſuffer confinement by the officer who liſted them, 'till they do take it.

The magiſtrate is obliged, in both caſes, to certify, that ſuch perſons are duly liſted; ſetting forth their birth, age, and calling, if known; and that the ſecond and ſixth ſections of the articles of war againſt mutiny and deſertion were read to them, and that they had taken the oath.

Officers offending herein are to be caſhiered, and diſplaced from their office; to be diſabled from holding any poſt, civil or military; and to forfeit 100l.

Perſons receiving inliſting-money from any officer, knowing him to be ſuch, and afterwards abſconding, and refuſing to go before a magiſtrate to declare their aſſent or diſſent, are deemed to be inliſted to all intents and purpoſes, and may be proceeded againſt as if they had taken the oath.

LIEZIERE. See Berm. See Fortification.

LOCHABER-AX, a tremendous Scotch weapon, now uſed by none but the town-guard of Edinburgh; one of which is to be ſeen among the ſmall armory in the Tower of London.

LOCKS, in *gunnery*, are of various ſorts; common for lockers in travelling-carriages, or for boxes containing ſhot, powder, or cartridges. Alſo locks for fire arms.

To LOCK, in a *military ſenſe*, is to faſten one or more of the wheels from going round, in going down a hill, &c.

LOCKER-*hinges*, ſerve to faſten the cover of the lockers in travelling-carriages.

LOCKING-*plates*, in *artillery*, are thin flat pieces of iron nailed on the ſides of a field-carriage, where the wheels touch it in turning, to prevent the wearing the wood in thoſe places. See CARRIAGE.

LOCKSPIT, in *field-fortification*, a ſmall cut or trench made with a ſpade, about a foot wide, to mark out the firſt lines of a work.

LODGEMENT, in *military buſineſs*, is a work made by the beſiegers in ſome part of a fortification, after the beſieged have been drove out, to maintain it, and to be covered from the enemy's fire.

When a *lodgement* is to be made on the glacis, covert-way, or in a breach, there muſt be a great proviſion made of faſcines, ſand-bags, gabions, wool-packs, &c. in the trenches; and, during the action, the pioneers (under the direction of an engineer) with faſcines, ſand-bags, &c. ſhould be making the lodgement, in order to form a covering, while the grenadiers are ſtorming the covert-way, &c.

LONGIMETRY, the art of meaſuring lengths, acceſſible and inacceſſible.

LONGITUDE *of the earth*, denotes its extent from weſt to eaſt, according to the direction of the equator.

LONGITUDE *of a place*, in *geography*, its diſtance from ſome firſt meridian, or an arch of the equator intercepted between the meridian of the place, and the firſt meridian. See GEOGRAPHY.

LONGITUDE *of motion*, according to ſome philoſophers, is the diſtance which the centre of any moving body runs through, as it moves on in a right line. See MOTION.

LOOP, in a *ſhip-carriage*, made of iron, faſtened one on the front of a fore axle-tree, and two on each ſide, through which the ropes or tackle paſs, whereby the guns are moved backwards and forwards on board of ſhips.

LOOP-*holes*, in old forts, &c. are ſquare or oblong holes made in the wall to fire through with ſmall arms.

LOUIS, *or Knight of St. Louis*, the name of a military order in France, inſtituted by Louis XIV. in 1693. Their collars are of a flame-colour, and paſs from left to right: the king is always grand maſter.

LUNETTES, in *fortification*, are works made on both ſides of the ravelin: one of their faces is perpendicular to half or two thirds of the faces of the ravelin; and the other nearly ſo to thoſe of the baſtions.

LUNETTES, are alſo works made beyond the ſecond ditch, oppoſite to the places of arms: they differ from the ravelins only in their ſituation. See FORTIFICATION.

LUNETTONS, are a ſmaller ſort of *lunettes*.

LYCANIENS. See PANDOURS.

M

MACHICOULIS, is an old word, ſometimes applied to projections in old caſtles, and over gates of towns, left open above, to throw down ſtones, &c. on the approaching enemy.

MACHINE, in *general*, whatever hath force ſufficient to raiſe or ſtop the motion of a heavy body.

MACHINES, are either ſimple or compound: the ſimple ones are the 7 mechanical powers, viz. lever, balance, pully, axis and wheel, ſcrew, and inclined plane. See MECHANICAL POWERS.

If the given power is not able to overcome the given reſiſtance when directly applied, that is, when the power applied is leſs than the weight or reſiſtance given; then the thing is to be performed by the help of a *machine* made with levers, wheels, pullies, ſcrews, &c. ſo adjuſted, that when the weight and power are put in motion on the *machine*, the velocity of the power may be at leaſt ſo much greater than that of the weight, as the weight and friction of the *machine*, taken together, is greater than the power; for on this principle depends the mechaniſm or contrivance of all mechanical en-

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LOCKS, in *gunnery*, are of various ſorts; common for lockers in travelling-carriages, or for boxes containing ſhot, powder, or cartridges. Alſo locks for fire arms.

To Lock, in a *military ſenſe*, is to faſten one or more of the wheels from going round, in going down a hill, &c.

LOCKER-*hinges*, ſerve to faſten the cover of the lockers in travelling-carriages.

LOCKING-*plates*, in *artillery*, are thin flat pieces of iron nailed on the ſides of a field-carriage, where the wheels touch it in turning, to prevent the wearing the wood in thoſe places. See Carriage.

LOCKSPIT, in *field-fortification*, a ſmall cut or trench made with a ſpade, about a foot wide, to mark out the firſt lines of a work.

LODGEMENT, in *military buſineſs*, is a work made by the beſiegers in ſome part of a fortification, after the beſieged have been drove out, to maintain it, and to be covered from the enemy's fire.

When a *lodgement* is to be made on the glacis, covert-way, or in a breach, there muſt be a great proviſion made of faſcines, ſand-bags, gabions, wool-packs, &c. in the trenches; and, during the action, the pioneers (under the direction of an engineer) with faſcines, ſand-bags, &c. ſhould be making the lodgement, in order to form a covering, while the grenadiers are ſtorming the covert-way, &c.

LONGIMETRY, the art of meaſuring lengths, acceſſible and inacceſſible.

LONGITUDE *of the earth*, denotes its extent from weſt to eaſt, according to the direction of the equator.

Longitude *of a place*, in *geography*, its diſtance from ſome firſt meridian, or an arch of the equator intercepted between the meridian of the place, and the firſt meridian. See Geography.

Longitude *of motion*, according to ſome philoſophers, is the diſtance which the centre of any moving body runs through, as it moves on in a right line. See Motion.

LOOP, in a *ſhip-carriage*, made of iron, faſtened one on the front of a fore axle-tree, and two on each ſide, through which the ropes or tackle paſs, whereby the guns are moved backwards and forwards on board of ſhips.

Loop-*holes*, in old forts, &c. are ſquare or oblong holes made in the wall to fire through with ſmall arms.

LOUIS, *or Knight of St. Louis*, the name of a military order in France, inſtituted by Louis XIV. in 1693. Their collars are of a flame-colour, and paſs from left to right: the king is always grand maſter.

LUNETTES, in *fortification*, are works made on both ſides of the ravelin: one of their faces is perpendicular to half or two thirds of the faces of the ravelin; and the other nearly ſo to thoſe of the baſtions.

Lunettes, are alſo works made beyond the ſecond ditch, oppoſite to the places of arms: they differ from the ravelins only in their ſituation. See Fortification.

LUNETTONS, are a ſmaller ſort of *lunettes*.

LYCANIENS. See Pandours.

M

MACHICOULIS, is an old word, ſometimes applied to projections in old caſtles, and over gates of towns, left open above, to throw down ſtones, &c. on the approaching enemy.

MACHINE, in *general*, whatever hath force ſufficient to raiſe or ſtop the motion of a heavy body.

Machines, are either ſimple or compound: the ſimple ones are the 7 mechanical powers, viz. lever, balance, pully, axis and wheel, ſcrew, and inclined plane. See Mechanical Powers.

If the given power is not able to overcome the given reſiſtance when directly applied, that is, when the power applied is leſs than the weight or reſiſtance given; then the thing is to be performed by the help of a *machine* made with levers, wheels, pullies, ſcrews, &c. ſo adjuſted, that when the weight and power are put in motion on the *machine*, the velocity of the power may be at leaſt ſo much greater than that of the weight, as the weight and friction of the *machine*, taken together, is greater than the power; for on this principle depends the mechaniſm or contrivance of all mechanical engines uſed to draw or raiſe heavy bodies, or overcome any other force; the whole deſign of theſe being to give ſuch a velocity to the power, in reſpect of the weight, as that the momentum of the power may exceed the momentum of the weight: for if *machines* are ſo contrived, that the velocity of the agent and reſiſtant are reciprocally as their forces, the agent will juſt ſuſtain the reſiſtant, but with a greater degree of velocity will overcome it. So that if the exceſs of motion or velocity in the power is ſo great as to overcome all that reſiſtance which commonly ariſes from the friction or attrition of contiguous bodies, as they ſlide by one another, or from the coheſion of bodies that are to be ſeparated, or from the weights of bodies that are to be raiſed; the exceſs of the force remaining, after all theſe reſiſtances are overcome, will produce an acceleration of motion thereto, as well in the parts of the *machine*, as in the reſiſting body.

Compound MACHINES, are formed by various combinations, and ſerve for different purpoſes; in all which the ſame general law takes place, viz. that the power and weight ſuſtain each other, when they are in the inverſe proportion of the velocities they would have in the directions wherein they act, if they were put in motion. Now, to apply this law to any compound *machine*, there are four things to be conſidered: 1. The moving power, or the force that puts the *machine* in motion; which may be either men or other animals, weights, ſprings, the wind, a ſtream of water, &c. 2. The velocity of this power, or the ſpace it moves over in a given time. 3. The reſiſtance, or quantity of weight to be removed. 4. The velocity of this weight, or the ſpace it moves over in the ſame given time.

The two firſt of theſe quantities are always in the reciprocal proportion of the two laſt; that is, the product of the firſt two muſt always be equal to that of the laſt: hence, three of theſe quantities being given, it is eaſy to find the fourth; for example, if the quantity of the power be 4, its velocity 15, and the velocity of the weight 2, then the reſiſtance, or quantity of the weight, will be equal to $\frac{4\times15}{2}=\frac{60}{2}=30$.

The following rules will direct the mechanic how he may contrive his *machine*, that it may anſwer the intended purpoſe, to the beſt advantage.

1. Having aſſigned the proportion of your power, and the weight to be raiſed, the next thing is to conſider how to combine levers, wheels, pullies, &c. ſo that, working together, they may be able to give a velocity to the power, which ſhall be to that of the weight ſomething greater than in the proportion of the weight to the power. This done, you muſt eſtimate your quantity of friction; and if the velocity of the power be to that of the weight ſtill in a greater proportion than the weight and friction taken together are to the power; then your *machine* will be able to raiſe the weight. And note, this proportion muſt be ſo much greater, as you would have your engine work faſter.

2. But the proportion of the velocity of the power and weight muſt not be made too great: for it is a fault to give a *machine* too much power, as well as too little: for if the power can raiſe the weight and overcome the reſiſtance, and the engine perform its proper effect in a convenient time, and work well, it is ſufficient for the end propoſed: and it is in vain to make additions to the engine to increaſe the power any farther; for that would not only be a needleſs expence, but the engine would loſe time in working.

3. As to the power applied to work the engine, it may be either a living power, as men, horſes, &c. or an artificial power, as a ſpring, &c. or a natural power, as wind, water, fire, weights, &c.

When the quantity of the power is known, it matters not, as to the effect, what kind of power it is; for the ſame quantity of any ſort will produce the ſame effect; and different ſorts of powers may be applied in an equal quantity a great variety of ways.

The moſt eaſy power applied to a *machine* is weight, if it be capable of effecting the thing deſigned. If not, then wind, water, &c. if that can be conveniently had, and without much expence.

A ſpring is alſo a convenient moving power for ſeveral *machines*: but it never acts equally as the weight does; but is ſtronger when much bent, than when but a little bent, and that in proportion to the bending, or the diſtance it is forced to: but ſprings grow weaker by often bending, or remaining long bent; yet they recover part of their ſtrength by lying unbent.

The natural powers, wind and water, may be applied to vaſt advantage in working of great engines, when managed with great ſkill and judgement. The due application of theſe has much abridged the labours of men; for there is ſcarce any labour to be performed, but an ingenious artificer can tell how to apply theſe powers to execute his deſign, and anſwer his purpoſe; for any conſtant motion being given, it may, by due application, be made to produce any other motions we deſire. Therefore theſe powers are the moſt eaſy and uſeful, and of the greateſt benefit to mankind. Beſides, they coſt nothing, nor require any repetition or renewing, like a weight or a ſpring, which require to be wound up. When theſe cannot be had, or cannot ſerve our end, we have recourſe to ſome living power, as men, horſes, &c.

4. Men may apply their ſtrength ſeveral ways in working a *machine*. A man of ordinary ſtrength, turning a roller by the handle, can act for a whole day againſt a reſiſtance equal to 30 pounds weight; and if he works 10 hours in a day, he will raiſe a weight 30lb. 3½ feet in a ſecond; or if the weight be greater, he will raiſe it ſo much leſs in proportion.

But a man may act, for a ſmall time, againſt a reſiſtance of 50lb. or more.

If two men work at a windlaſs or roller, they can more eaſily draw up 70lb. than one man 30lb. provided the elbow of one of the handles be at right angles to that of the other: and with a fly or heavy wheel applied to it, a man may do 1-3d part more work; and for a little while act with a force, or overcome a continual reſiſtance of 80lb. and work a whole day when the reſiſtance is but 40lb.

Men uſed to carrying, ſuch as porters, will carry ſome 150lb. others 200lb. or 250lb. according to their ſtrength.

A man can draw but about 70 or 80lb. horizontally; for he can but apply half his weight.

If the weight of a man be 140lb. he can act with no greater force in thruſting horizontally, at the height of his ſhoulders, than 27lb.

A horſe draws to greateſt advantage, when the line of direction is a little elevated above the horizon, and the power acts againſt his breaſt; and can draw 200lb. for eight hours in a day, at two miles and a half an hour. If he draws 240lb. he can work but 6 hours, and not quite ſo faſt; and, in both caſes, if he carries ſome weight, he will draw better than if he carried none. And this is the weight a horſe is ſuppoſed to be able to draw over a pully out of a well. In a cart a horſe may draw 1000lb. The moſt force a horſe can exert is when he draws ſomething above a horizontal poſition.

The worſt way of applying the ſtrength of a horſe, is to make him draw or carry up a hill: and three men with 100lb. on their backs, will climb up a ſteep hill faſter than a horſe with 300lb.

A round walk for a horſe to draw in, at a mill, &c. ſhould not be leſs than 40 feet diameter.

5. Every machine ſhould be made of as few parts, and thoſe as ſimple, as poſſible, to anſwer its purpoſe; not only becauſe the expence of making and repairing will be leſs, but it will alſo be leſs liable to any diſorder: and it is needleſs to do a thing with many, which may be done with fewer parts.

6. If a weight is to be raiſed but a very little way, the lever is the moſt ſimple, eaſy, and ready machine; or, if the weight be very great, the common ſcrew is moſt proper: but if the weight is to be raiſed a great way, the wheel and axle is a proper power, and blocks and pullies are eaſier ſtill; and the ſame may be done by the perpetual ſcrew.

Great wheels, to be wrought by men or cattle, are of moſt uſe and convenience, when their axles are perpendicular to the horizon; but if by water, &c. then it is beſt to have their axles horizontal.

7. As to the combination of ſimple *machines* together, to make a compound one, though the lever when ſimple cannot raiſe a weight to any great height, and in this caſe is but of little ſervice; yet it is of great uſe when compounded with others. Thus the ſpokes of a great wheel are all levers perpetually acting; and a beam fixed to the axis to draw the wheel about by men or horſes, is a lever. The lever alſo may be combined with the ſcrew, but not conveniently with pullies, or with the wedge. The wheel and axle is combined with great advantage with pullies; but the perpetual ſcrew combined with the wheel is very ſerviceable. The wedge cannot be combined with any other mechanical power; and it only performs its effect by percuſſion; but this force of percuſſion may be increaſed by engines.

Pullies may be combined with pullies, and wheels with wheels. Therefore if any ſingle wheel would be too large, and take up too much room, it may be divided into 2 or 3 more wheels and trundles, or wheels and pinions, as in clock-work, ſo as to have the ſame power, and perform the ſame effect.

In wheels with teeth, the number of teeth that play together in 2 wheels, ſhould be prime to each other, that the ſame teeth may not meet at every revolution; for when different teeth meet, they by degrees wear themſelves into a proper figure: therefore they ſhould ſo be contrived that the ſame teeth meet as ſeldom as poſſible.

8. The ſtrength of every part of the *machine* ſhould be made proportional to the ſtreſs it is to bear: and therefore let every lever be made ſo much ſtronger, as its length and the weight it is to ſupport are greater; and let its ſtrength diminiſh proportionally from the fulcrum, or point where the greateſt ſtreſs is to each end. The axles of wheels and pullies muſt be ſo much ſtronger as they are to bear greater weight. The teeth of wheels, and the wheels themſelves, which act with greater force, muſt be proportionally ſtronger; and in any combination of wheels and axles, make their ſtrength diminiſh gradually from the weight to the power, ſo that the ſtrength of every part be reciprocally as the velocity it has. The ſtrength of ropes muſt be according to their tenſion, and that is as the ſquares of their diameters: and, in general, whatever parts a *machine* is compoſed of, the ſtrength of every particular part of it muſt be adjuſted to the ſtreſs upon it; therefore in ſquare beams the cubes of the diameters muſt be made proportional to the ſtreſs they bear: and let no part be ſtronger or bigger than is neceſſary for the ſtreſs upon it; not only for the eaſe and well going of the *machine*, but for diminiſhing of the friction; for all ſuperfluous matter in any part of it, is nothing but a dead weight upon the machine, and ſerves for nothing but to clog its motion; and he is by no means a perfect mechanic, that does only adjuſt the ſtrength to the ſtreſs, but who alſo contrives all the parts to laſt equally well, that the whole *machine* may fall together.

9. To have the friction as little as poſſible, the *machine* ſhould be made of the feweſt and ſimpleſt parts. The diameters of the wheels and pullies ſhould be large, and the diameters of the arbors or ſpindles they run on, as ſmall as can be conſiſtent with their ſtrength. All ropes and cords muſt be as pliable as poſſible, and for that end rubbed with tar or greaſe: the teeth of wheels muſt be made to fit and fill up the openings, and cut into the form of epicycloids. All the axles, where the motion is, and all teeth where they work, and all parts that in working rub upon one another, muſt be made ſmooth; and when the machine goes, muſt be oiled or greaſed.

10. When any motion is to be long continued, contrive the power to move or act always one way, if it can be done; for this is better and eaſier performed than when the motion is interrupted, and the power is forced to move firſt one way, and then another; becauſe every change of motion requires a new additional force to effect it. Beſides, a body in motion cannot ſuddenly receive a contrary motion, without great violence: and the moving any part of the *machine* contrary ways by turns, with ſudden jerks, tends only to ſhake the *machine* to pieces.

11. In a *machine* that moves always one way, endeavour to have the motion uniform.

12. But when the nature of the thing requires that a motion is to be ſuddenly communicated to a body, or ſuddenly ſtopped: to prevent any damage or violence to the engine by a ſudden jolt, let the force act againſt ſome ſpring, or beam of wood, which may ſupply the place of a ſpring.

13. In regard to the ſize of the *machine*, let it be made as large as it can conveniently. The greater the *machine*, the exacter it will work, and perform all its motions the better; for there will always be ſome errors in the making, as well as in the materials, and conſequently in the working of the *machine*. The reſiſtance of the medium in ſome *machines* has a ſenſible effect: but all theſe mechanical errors bear a leſs proportion to the motion of the *machine* in great machines than in little ones; being nearly reciprocally as their diameters, ſuppoſing they are made of the ſame matter, and with the ſame accuracy, and are equally well finiſhed: therefore in a ſmall *machine* they are more ſenſible, but in a great one almoſt vaniſh; therefore great *machines* will anſwer better than ſmall ones, in all reſpects, except in ſtrength; for the greater the *machine*, the weaker it is, and leſs able to reſiſt any violence.

14. For engines that go by water, it is neceſſary to meaſure the velocity and force of the water. To get the velocity, drop in pieces of ſticks, &c. and obſerve how far they are carried in a ſecond, or any given time.

But if it flows through a hole in a reſervoir, or ſtanding receptacle of water, the velocity will be found from the depth of the whole below the ſurface.

Thus let $s = 16\frac{1}{12}$ feet; $v =$ velocity of the fluid per ſecond; $B =$ the area of the hole; $H =$ the height of the water; all in feet. Then the velocity $v = \sqrt{2sH}$; and its force $=$ the weight of the quantity $\frac{vv}{2s}B$ or HB of water, or $= \frac{62\frac{1}{2}}{112}HB$ hundred weight: becauſe

cauſe a cubic foot=62 $\frac{1}{2}$ lb. avoirdup. Alſo a hogſhead is about 8 $\frac{1}{2}$ feet, or 531 lb. and a tun is 4 hogſheads.

When you have but a ſmall quantity of water, you muſt contrive it to fall as high as you can, to have the greater velocity, and conſequently more force upon the engine.

15. If water is to be conveyed through pipes to a great diſtance, and the deſcent be but ſmall, much larger pipes muſt be uſed, becauſe the water will come ſlow.

Water ſhould not be driven through pipes faſter than 4 feet per ſecond, by reaſon of the friction of the tubes; nor ſhould it be too much wire-drawn, that is, ſqueezed through ſmaller pipes, for that creates a reſiſtance, as water-way is leſs in narrow pipes.

16. When any thing is to be performed by a water-wheel, moved by the water running under it and ſtriking the paddles or ladle-boards, the channel it moves in ought to be ſomething wider than the hole of the adjutage, and ſo cloſe to the floats on every ſide as to let little or no water paſs; and when paſt the wheel, to open a little, that the water may ſpread. It is of no advantage to have a great number of floats or paddles; for thoſe paſt the perpendicular are reſiſted by the back-water, and thoſe before it are ſtruck obliquely. The greateſt effect that ſuch a wheel can perform, in communicating any motion, is when the paddles of the wheel move with $\frac{1}{3}$ the velocity of the water, in which caſe, the force upon the paddle is $\frac{4}{9}$ only; ſuppoſing the abſolute force of the water againſt the paddle, when the wheel ſtands ſtill, to be 1: ſo that the utmoſt motion which the wheel can generate, is but $\frac{4}{27}$ of that which the force of the water againſt the paddles at reſt would produce. This is when the wheel is at the beſt; but ſometimes far leſs is done.

There is ſtill another ſpecies of *machine*, which acts by a diſtinct power, the compreſſion and expanſion of air; invented and brought to perfection by the ingenious Mr. Blakey, who has obtained his majeſty's patent for ſecuring to himſelf the advantages that may reſult from their uſe.

MADRIERS, in the *military art*, are long planks of broad wood, uſed for ſupporting the earth in mining, carrying on a ſap, making coffers, caponiers, galleries, and various other purpoſes at a ſiege; alſo to cover the mouth of petards after they are loaded, and are fixed with the petards to the gates or other places deſigned to be forced open. When the planks are not ſtrong enough, they are doubled with plates of iron.

MAGAZINE, a place in which ſtores are kept, or arms, ammunition, proviſions, &c. Every fortified town ought to be furniſhed with a large magazine, which ſhould contain ſtores of all kinds, ſufficient to enable the garriſon and inhabitants to hold out a long ſiege, and in which ſmiths, carpenters, wheel-wrights, bakers, &c. may be employed in making every thing belonging to the artillery, as carriages, waggons, &c.

Powder-MAGAZINE, is that place where the powder is kept in very large quantities. Authors differ greatly both in regard to ſituation and conſtruction; but all agree, that they ought to be arched, and bomb-proof. In fortifications they are frequently placed in the rampart; but of late, they have been built in different parts of the town. The firſt powder-magazines were made with Gothic arches; but M. Vauban, finding them too weak, conſtructed them in a ſemicircular form, whoſe dimenſions are, 60 feet long, within; 25 broad; the foundations are 8 or 9 feet thick, and 8 feet high from the foundation to the ſpring of the arch; the floor is 2 feet from the ground, which keeps it from dampneſs.

One of our engineers of great experience ſome time ſince had obſerved, that after the centres of ſemicircular arches are ſtruck, they ſettle at the crown and riſe up at the hances, even with a ſtraight horizontal extrados, and ſtill much more ſo in powder-magazines, whoſe outſide at top is formed like the roof of a houſe, by two inclined planes joining in an angle over the top of the arch, to give a proper deſcent to the rain; which effects are exactly what might be expected agreeable to the true theory of arches. Now, as this ſhrinking of the arches, muſt be attended with very ill conſequences, by breaking the texture of the cement after it has been in ſome degree dried, and alſo by opening the joints of the vouſſoirs at one end, ſo a remedy is provided for this inconvenience, with regard to bridges, by the *arch of equilibration* in Mr. Hutton's book on bridges; but, as the ill effect is much greater in powder-magazines, the ſame ingenious gentleman propoſed to find an arch of equilibration for them alſo, and to conſtruct it when the ſpan is 20 feet, the pitch or height 10, (which are the ſame dimenſions as the ſemicircle) the inclined exterior walls at top forming an angle of 113 degrees, and the height of their angular point above the top of the arch, equal to 7 feet: this very curious queſtion was anſwered in 1775 by the Rev. Mr. Wildbore, to be found in Mr. Hutton's *Miſcellanea Mathematica*, See Plate III. fig. 3.

He ſuppoſes D and C to be two points in the required arch, and that D is a given one. Draw the tangents Dg, Cg, and the vertical line Hg through their interſection till it meets the roof IK in H: then, in order that the wall $ICDK$ may reſt in equilibrio on the arch CD, it is neceſſary that its centre of gravity be in the line Hg: let Cb be an indefinitely ſmall part of the tangent Cg, or the fluxion of the arch CD; draw bb parallel to FK, or AB, and bq to Dg; then, in order that the wall may be ſupported in equilibrio by two forces in the directions Cb, Dg, theſe forces, and the gravity of the wall, muſt be as the three ſides Cb, qb, and qC of the triangle qCb parallel to thoſe forces. This premiſed, let $FK=x$, $FC=y$, $CI=u$, $bC=\dot{y}$, $bb=\dot{x}$, $c=$ the tangent of $FKI=30^\circ$, $30'$, $FI=cx$, $DG=m$, $KG=q$, (gD being continued to G); bq (by ſim. △ s) $=\frac{n\dot{x}}{q}$, $Cq=\dot{y}-\frac{n\dot{x}}{q}$, $bq=\frac{m\dot{x}}{q}$, the conſtant force acting at D along the curve $=a$, and the wall or area $ICDK=p$; then, from what is premiſed, as $a:\dot{p}::\frac{m\dot{x}}{q}:\dot{y}-\frac{n\dot{x}}{q}$, or $m\dot{p}\dot{x}=qa\dot{y}-na\dot{x}$; or making $\dot{x}$ conſtant, $qa\ddot{y}=m\ddot{p}\dot{x}$. Now the area of the $\triangle FIK=\frac{cx^2}{2}$, its fluxion $=cx\dot{x}$, and conſequently $\dot{p}=y\dot{x}-cx\dot{x}$, which being ſubſtituted for $\dot{p}$ in the laſt equation, gives $qa\ddot{y}=my\dot{x}^2-mcx\dot{x}^2$, or putting $\frac{qa}{m}=Q$, $\frac{Q\ddot{y}}{\dot{x}^2}=y-cx=CI=u$; ∵ $\dot{y}-c\dot{x}=\dot{u}$, $\ddot{y}=\ddot{u}$, $\frac{Q\ddot{y}}{\dot{x}^2}=\frac{Q\ddot{u}}{\dot{x}^2}=u$, $\frac{2Q\dot{u}\ddot{u}}{\dot{x}^2}$, and (taking the fluents) $\frac{Q\dot{u}^2}{\dot{x}^2}=u^2$: but ſince u and $\dot{u}$ do not begin together $\frac{Q\dot{u}^2}{\dot{x}^2}=u^2-d^2$, where $d=$ the value of u at the vertex of the curve $=7$; conſequently $\dot{x}=\frac{Q^{\frac{1}{2}}\dot{u}}{\sqrt{u^2-d^2}}$, and (again taking the correct fluents) $x=Q^{\frac{1}{2}}\times$ hyp. log. of $\frac{u+\sqrt{u^2-d^2}}{d}$. Now, if we ſuppoſe D to be the vertex of the arch LA (the greateſt value of u) $=b$, and AQ (the greateſt value of x) $=g$, we obtain $Q^{\frac{1}{2}}=\frac{g}{\text{hyp. log.}\frac{b+\sqrt{b^2-d^2}}{d}}$ which being known, the curve may be readily conſtructed from the above equation, or from the following, viz. $u=\frac{M^2+d^2}{2M}$, where $M=\frac{x}{dN\sqrt{Q}}$ and $N=2.71828$.

Corol. 1. Since at D the vertex, $FC=IC$, gD the tangent to the curve there muſt be parallel to LK, and conſequently the angle at the key-ſtone of the arch $=$ that of the roof.

Corol. 2. If the $\angle IKD$ be right, $c=0$, $u=y$, and $x=Q^{\frac{1}{2}}\times$ hyp. log. $\frac{y+\sqrt{y^2-d^2}}{d}$; which being the ſame caſe, is likewiſe the ſame concluſion as that derived by a very different method, at page 40 of Mr. Hutton's *Principles of Bridges*.

Artillery-MAGAZINE, in a *ſiege*, the magazine is made about 25 or 30 yards behind the battery, towards the parallels, and at leaſt 3 feet under ground, to hold the powder, loaded ſhells, portfires, &c. Its ſides and roof muſt be well ſecured with boards, to prevent the earth from falling in: a door is made to it, and a double trench or paſſage is ſunk from the magazine to the battery, one to go in and the other to come out at, to prevent confuſion. Sometimes traverſes are made in the paſſages to prevent ricochet ſhot from plunging into them. See Plate III.

MAGNITUDE, or *quantity*, any thing locally continued, or that has ſeveral dimenſions. Its origin is a point, which though void of parts, yet its flux forms a line, the flux of that a ſurface, and of that a body, &c.

MAIN-BODY *of the army*, the body of troops that march between the advance and rear-guards. In *a camp*, that part of the army encamped between the right and left wings.

MAIN-GUARD, or *grand-guard*, a body of horſe poſted before a camp for the ſecurity of an army. In *garriſon*, it is a guard generally mounted by a ſubaltern officer and about 24 men. See GUARD.

MAJOR, in the *art of war*, the name of ſeveral officers of very different ranks and functions.

MAJOR *of a regiment of foot*, the next officer to the lieutenant-colonel, generally promoted from the eldeſt captain: he is to take care that the regiment be well exerciſed, to ſee it march in good order, and to rally it in caſe of being broke in action: he is the only officer among the infantry that is allowed to be on horſeback in time of action, that he may the more readily execute the colonel's orders.

MAJOR *of a regiment of horſe*, as well as foot, ought to be a man of honour, integrity, underſtanding,

derſtanding, courage, activity, experience, and addreſs: he ſhould be maſter of arithmetic, and keep a detail of the regiment in every particular: he ſhould be ſkilled in horſemanſhip, and ever attentive to his buſineſs: one of his principal functions is, to keep an exact roſter of the officers for duty: he ſhould have a perfect knowledge in all the military evolutions, as he is obliged by his poſt to inſtruct others, &c.

Town-Major, the third officer in order in a garriſon, and next to the deputy-governor. He ſhould underſtand fortification, and has a particular charge of the guards, rounds, patroles, and centinels.

Brigade-Major, is a particular officer appointed for that purpoſe, only in camp: he goes every day to head-quarters to receive orders from the adjutant-general: there they write exactly whatever is dictated to them: from thence they go and give the orders, at the place appointed for that purpoſe, to the different majors or adjutants of the regiments which compoſe that brigade, and regulate with them the number of officers and men which each are to furniſh for the duty of the army; taking care to keep an exact roſter, that one may not give more than another, and that each march in their tour: in ſhort, the major of brigade is charged with the particular detail in his own brigade, in much the ſame way as the adjutant-general is charged with the general detail of the duty of the army. He ſends every morning to the adjutant-general an exact return, by battalion and company, of the men of his brigade miſſing at the retreat, or a report, expreſſing that none are abſent: he alſo mentions the officers abſent with or without leave.

As all orders paſs through the hands of the majors of brigade, they have infinite occaſions of making known their talents and exactneſs.

Major *of artillery*, is alſo the next officer to the lieutenant-colonel. His poſt is very laborious, as the whole detail of the corps particularly reſts with him; and for this reaſon all the non-commiſſioned officers are ſubordinate to him, as his title of ſerjeant-major imports: in this quality they muſt render him an exact account of every thing which comes to their knowledge, either regarding the duty or wants of the artillery and ſoldiers. He ſhould poſſeſs a perfect knowledge of the power of artillery, together with all its evolutions. In the field he goes daily to receive orders from the brigade-major, and communicates them with the parole to his ſuperiors, and then dictates them to the adjutant. He ſhould be a very good mathematician, and be well acquainted with every thing belonging to the train of artillery, &c.

Major *of engineers*, commonly with us called ſub-directors, ſhould be very well ſkilled in military architecture, fortification, gunnery, and mining. He ſhould know how to fortify in the field, to attack and defend all ſorts of poſts, and to conduct the works in a ſiege, &c. See Engineer.

Aid-Major, is on ſundry occaſions appointed to act as major, who has a pre-eminence above others of the ſame denomination. Our horſe and foot-guards have their guidons, or ſecond and third majors.

Serjeant-Major, is a non-commiſſioned officer, of great merit and capacity, ſubordinate to the adjutant, as he is to the major. See Serjeant.

Drum-Major, is not only the firſt drummer in the regiment, but has the ſame authority over his drummers as the corporal has over his ſquad. He inſtructs them in their different beats; is daily at orders with the ſerjeants, to know the number of drummers for duty. He marches at their head when they beat in a body. In the day of battle, or at exerciſe, he muſt be very attentive to the orders given him, that he may regulate his beats according to the movements ordered.

Fife-Major, is he that plays the beſt on that inſtrument, and has the ſame authority over the fifers as the drum-major has over the drummers. He teaches them their duty, and appoints them for guards, &c.

MALLEABLE, in the *art of founding*, a property of metals, whereby they are capable of being extended under the hammer.

MARTIOBARBULI, in *ancient military hiſtory*, a ſort of loaded javelins, five of which each ſoldier carried in the concavity of his ſhield.

Knights of MALTA, otherwiſe called *Hoſpitalers of St. John of Jeruſalem*, a religious military order, whoſe reſidence is in the iſland of Malta. The order conſiſts of three eſtates, the knights, chaplains, and ſervants at arms: none are admitted into this order, but ſuch as are of noble birth. They never marry, yet have continued from 1090 to the preſent time.

MANEGE, or *Manage*, in *horſemanſhip*, the exerciſe of riding the great horſe, or the ground ſet apart for that purpoſe; which is ſometimes covered, for continuing the exerciſe in bad weather; and ſometimes open, in order to give more liberty and freedom both to the horſeman and horſe.

MANIFESTO, in *military hiſtory*, a public declaration made by a prince in writing, ſhowing his intentions to begin a war, or rather enterpriſe, with the motives that induce him to it, and the reaſons on which he founds his rights and pretenſions.

MANIPULUS, in *ancient military hiſtory*, a body of Roman infantry, conſiſting of 200 men, and conſtituting the third part of a cohort.

MANŒUVRE, in a *military ſenſe*, conſiſts ſolely in diſtributing equal motion to every part of a body of troops, to enable the whole to form, or change their poſition, in the moſt expeditious and beſt method, to anſwer the purpoſes required of a battalion, brigade, or line of cavalry, infantry, or artillery. It has always been lamented, that men have been brought on ſervice without being informed of the uſes of the different manœuvres they have been practiſing; and having no ideas of any thing but the uniformity of the parade, inſtantly fall into diſorder and confuſion when they loſe the ſtep, or ſee a deviation from the ſtraight lines they have been accuſtomed to at exerciſe. It is a pity to ſee ſo much attention confined to ſhow, and ſo little given to inſtruct the troops in what may be of uſe to them on real ſervice.

No manœuvre ſhould be executed in the preſence of the enemy, unleſs protected by ſome diviſion of the troops.

MANTELETS, in a *military ſenſe*, are either ſingle or double, compoſed of great planks of wood, of about 5 feet high, and 3 inches thick. The ſingle ones are ſometimes covered with tin, made muſket-proof, which the pioneers generally roll before them, being fixed upon wheels, to cover them from the enemy's fire, in opening the trenches, or carrying on the ſap, &c. The double ones form an angle, and ſtand ſquare, making two fronts, which cover both the front and flank of the ſappers, &c. when at work: theſe have double planks, with earth rammed in between them: they are 5 feet high, and 3 in breadth, ſometimes covered with plates of iron. They may with propriety be called a moving parapet, having a ſhaft to guide them by.

MAP, in a *military and geographical ſenſe*, is a plane figure, repreſenting the ſurface of the earth, or a part thereof, according to the laws of perſpective; diſtinguiſhing the ſituation of cities, mountains, rivers, roads, &c.

In maps theſe three things are eſſentially neceſſary. 1. That all places have the ſame ſituation and diſtance from the great circles therein, as on the globe, to ſhow their parallels, longitudes, zones, climates, and celeſtial appearances. 2. That their magnitudes be proportionable to the real magnitudes on the globes. 3. That all places have the ſame ſituation, bearing, and diſtance, as on the earth itſelf.

MAPS are either univerſal, which exhibit the whole ſurface of the earth; or partial, which exhibit ſome particular part thereof: each kind is called geographical or land-maps, in contradiſtinction to hydrographical or ſea-maps, repreſenting the ſeas and ſea-coaſts, properly called charts.

As a *map* is a repreſentation of ſome part of the ſurface of the earth delineated upon a plane; the earth being round, no part of the ſpherical ſurface of it can be accurately exhibited upon a plane; and therefore ſome have propoſed the making of globular *maps*. For this purpoſe a plate of braſs might be hammered, or at a leſs expence a piece of paſte-board might be formed into a ſegment of a ſphere, and covered on its convex ſide with a *map* projected in the ſame manner as the papers of the common globe are. A *map* made in this method would ſhow every thing in the ſame manner, as it would be ſeen upon a globe of the ſame diameter with the ſphere upon the ſegment of which it was delineated: and, indeed, maps of this ſort would in effect be ſegments of ſuch a globe; but they are not in common uſe.

The ancients deſcribed all parts of the known earth in one general *map*. In this view one of them compares the ſhape of the earth to the leather of a ſling, whoſe length exceeds its breadth: the length of the then known parts of the earth from eaſt to weſt was conſiderably greater, than from north to ſouth; for which reaſon, the former of theſe was called the longitude, and the other the latitude.

The modern general *maps* are ſuch as give us a view of an entire hemiſphere, or half of the globe; and are projected upon the plane of ſome great circle, which terminates the projected hemiſphere, and divides it from the other half of the globe, as the equator, the meridian, or horizon of ſome place. From the circle the projection is denominated, and ſaid to be equatorial, meridional, or horizontal.

Particular *maps* are ſuch as exhibit to us leſs than an hemiſphere: of this ſort are *maps* of the great parts into which the earth is divided, as Europe, Aſia, Africa, and America; or *maps* of particular kingdoms, provinces, countries, or of leſſer diſtricts.

A particular *map* is a part of a general one, and may be made upon the ſame principles, as by projecting a large hemiſphere, and taking ſo much of it as the *map* is deſigned to contain. When we are to delineate a *map* of the ſmaller part of the earth, if it be near the equator, the meridians and parallels may be repreſented by equi-diſtant ſtraight lines. If at ſome diſtance from the equator, the parallels may be equi-diſtant ſtraight lines, and the meridians ſtraight lines, a little converging towards the neareſt pole; or the meridians may be ſtraight lines, converging towards the neareſt pole, and the parallels circular.

When we are to make a *map* of a very ſmall diſtrict, as of a county or hundred, whatever part of the earth it be in, the meridians and parallels may be equi-diſtant ſtraight lines, drawn through every minute, &c. of longitude, according as the largeneſs of the *map* will allow. See PLOTTING and SURVEYING.

The uſe of *maps* is obvious from their conſtruction. The degrees of the meridians and parallels ſhew the longitude and latitude of places; their bearings from each other appear from inſpection; and their diſtances from each other may be meaſured by the diviſions on the meridian, equator, or ſcales. See GEOGRAPHY.

MARAUDING, in a *military ſenſe*, means a party of ſoldiers, who, without any order, go into the neighbouring houſes or villages, when the army is either in camp or garriſon, to plunder and deſtroy, &c. Marauders are a diſgrace to the camp, to the military profeſſion, and deſerve no better quarters from their officers than they give to poor peaſants, &c.

A MARCH, is the moving of a body of men from one place to another. Care muſt be taken, in marching of troops, that they are not liable to be flanked or intercepted; for of all operations none is more difficult, becauſe they muſt not only be directed in the objects they have in view, but according to the movements the enemy may have made.

Of all the mechanical parts of war, none is more eſſential than that of marching. It may be juſtly called the key which leads to all ſublime motions and manœuvres of an army; for they depend entirely on this point. A man can be attacked in four different ways; in the front, on both flanks, and in the rear: but he can defend himſelf, and annoy the enemy, only when placed with his face towards him. Hence it follows, that the general object of marching, is reduced to three points only; to march forwards, and on both ſides, becauſe it is impoſſible to do it for any time backwards, and by that means face the enemy wherever he preſents himſelf. The different ſteps to be made uſe of are three; ſlow, faſt, and oblique. The firſt is proper in advancing, when at a conſiderable diſtance from the enemy, and when the ground is unequal, that the line may not be broke, and a regular fire kept up without intermiſſion. The ſecond is chiefly neceſſary, when you want to anticipate the enemy in occupying ſome poſt, in paſſing a defile, and, above all, in attacking an intrenchment, to avoid being a long while expoſed to the fire of the artillery and ſmall-arms, &c. The third ſtep is of infinite conſequence, both in the infantry and cavalry: columns may be opened and formed into lines, and, *vice verſa*, lines into columns, by this kind of ſtep, in a leſſer ſpace, and conſequently in leſs time, than by any other method whatſoever. In coming out of a defile, you may inſtantly form the line without preſenting the flank to the enemy. The line may be formed, though ever ſo near to the enemy, with ſafety, becauſe you face him, and can with eaſe and ſafety protect and cover the motion of the troops, while they are coming out of the defiles, and forming. The ſame thing may be equally executed, when a column is to be formed, in order to advance or retreat; which is a point of infinite conſequence, and ſhould be eſtabliſhed as an axiom.

The order of *march* of the troops muſt be ſo diſpoſed, that each ſhould arrive at their rendezvous, if poſſible, on the ſame day. The quarter-maſter-general, or his deputy, with an able engineer, ſhould ſufficiently reconnoitre the country, to obtain a perfect knowledge of it and the enemy, before he forms his routes.

Before a *march*, the army generally receives ſeveral days bread. The quarter-maſters, camp-colour-men, and pioneers, parade according to orders, and march immediately after, commanded by the quarter-maſter-general, or his deputy. They are to clear the roads, level the ways, make preparations for the march of the army, &c. The *general*, for inſtance, beats at 2, the *aſſembly* at 3, and the army to march in 20 minutes after. Upon beating the *general*, the village, and general officer's guards, quarter and rear guards, join their reſpective corps; and the army pack up their baggage. Upon beating the *aſſembly*, the tents are to be ſtruck, and ſent with the baggage to the place appointed, &c.

The companies draw up in their ſeveral ſtreets, and the rolls are called. At the time appointed, the drummers are to beat a march, and fifers play at the head of the line; upon which the companies *march* out from their ſeveral ſtreets, form battalions as they advance to the head of the line, and then halt.

The ſeveral battalions will be formed into columns by the adjutant-general, and the order of march, &c. be given to the general officers who lead the columns.

The cavalry generally march by regiments or ſquadrons. The heavy artillery always keeps the great roads, in the centre of the columns, eſcorted by a ſtrong party of infantry and cavalry. The field-pieces march with the columns.

Each ſoldier generally marches with 36 rounds of powder and ball, and 2 good flints; one of which is to be fixed in the cock of his firelock. The routes muſt be formed, ſo that no columns croſs another on the march.

MARQUE, or *Letters of Marque*, in *military affairs*, are letters of repriſal, granting the ſubjects of one prince or ſtate liberty to make repriſals on thoſe of another. See LETTERS *of* MARQUE.

MARINE, implies, in general, the whole navy of a kingdom or ſtate, comprehending all the royal dock-yards, and the officers, artificers, ſeamen, ſoldiers, &c. employed therein, as well as the ſhipping employed by the merchants for military or commercial purpoſes; together with whatever relates to navigation, ſhip building, ſailors, and marines.

The hiſtory of the marine affairs of any one ſtate is a very comprehenſive ſubject; much more that of all nations. Not only the preſervation of that ſhare of commerce we at preſent poſſeſs, but its future advancement, and even the very being of Britain, as an independent empire, and a free people, depend no leſs on the good condition and the wiſe regulation of our affairs of the marine, than on the ſuperiority of its naval power. The Delphian oracle being conſulted by the Athenians, on the formidable armament and innumerable forces of Xerxes, returned for anſwer, "that they muſt ſeek their ſafety in "wooden walls." To which we may affirm, that whenever this nation in particular has recourſe to her floating bulwarks for her ſecurity and defence, ſhe will find ſtrength, wealth, and glory, to be the happy and infallible conſequence.

MARINE *forces*, MARINES, a body of ſoldiers, raiſed for the ſea-ſervice, and trained to fight either in a naval engagement, or in an action on ſhore. They are under the direction of the lords of the admiralty. The marine forces of Great-Britain, in time of peace, are ſtationed in 3 diviſions; one of which is quartered at Chatham, one at Portſmouth, and another at Plymouth; that is, 16 companies at Chatham, 27 at Portſmouth, and 27 at Plymouth; making in all 70 companies.

MARLIN, in *artillery*, are tarred white ſkains or long wreaths or lines of untwiſted hemp, dipped in pitch or tar, with which cables and other ropes are wrapped round, to prevent their fretting or rubbing in the blocks or pullies through which they paſs. The ſame ſerves in artillery upon ropes uſed for rigging gins, uſually put up in ſmall parcels called ſkains.

MARSHAL, *Field*-MARSHAL, in its primitive ſignification, means an officer who has the care and charge of horſes; but it is now applied to officers who have very different employments. In a military ſenſe, it means the commander in chief of all the forces. See GENERAL.

MARSHAL *of France*, an officer of the greateſt dignity in the French army. It was firſt eſtabliſhed by Philip-Auguſt, in the year 1185.

MARSHAL *de camp*. See MAJOR-GENERAL.

MARTIAL-*Law*, is the law of war, which entirely depends on the arbitrary power of the prince, or of thoſe to whom he has delegated it; for, though the king can make no laws in time of peace without the conſent of parliament, yet in time of war he uſes an abſolute power over the army.

MASTER *at arms*, in the *marine*, an officer appointed to teach the officers and crew of a ſhip of war the exerciſe of the ſmall-arms; to confine, and plant centinels over, the priſoners, and ſuperintend whatever relates to them during their confinement. He is alſo to obſerve that the fire and lights are all extinguiſhed as ſoon as the evening-gun is fired, except thoſe that are permitted by proper authority, or under the inſpection of centinels. It is likewiſe his duty to attend the gang-way, when any boats arrive aboard, and ſearch them carefully, together with their rowers, that no ſpirituous liquors may be conveyed into the ſhip, unleſs by permiſſion of the commanding officer. In theſe ſeveral duties he is aſſiſted with proper attendants, called his corporals, who alſo relieve the centinels, and one another, at certain periods.

MASTER *gunner*, in a *ſhip of war*, an officer appointed to take charge of the artillery and ammunition aboard, and to teach the men the exerciſe of the great guns.

MASTER *of the horſe*, a great officer of the crown, who orders all matters relating to the king's ſtables, races, breed of horſes; and commands

mands the equerries and all the other officers and tradeſmen in the king's ſtables. His coaches, horſes, and attendants, are the king's, and bear the king's arms and livery.

MASTER-*general of the ordnance.* See ORDNANCE.

MATCH, in *artillery*, a kind of rope ſlightly twiſted, and prepared to retain fire for the uſes of the artillery, mines, fire-works, &c. It is made of hempen tow, ſpun on the wheel like cord, but very ſlack; and is compoſed of three twiſts, which are afterwards again covered with tow, ſo that the twiſts do not appear: laſtly, it is boiled in the lees of old wines. This, when once lighted at the end, burns on gradually, without ever going out, 'till the whole be conſumed. It is mounted on a lint-ſtock.

Quick MATCH, uſed in *artillery*, made of three cotton ſtrands drawn into lengths, and put into a kettle juſt covered with white wine vinegar, and then a quantity of ſaltpetre and mealed powder is put in it, and boiled 'till well mixed. Others put only ſaltpetre into water, and after that take it out hot, and lay it into a trough with ſome mealed powder, moiſtened with ſome ſpirits of wine, thoroughly wrought into the cotton by rolling it backwards and forwards with the hands; and when this is done, they are taken out ſeparately, drawn through mealed powder, and dried upon a line. See LABORATORY.

MATHEMATICS, from μαθησις, originally ſignified any diſciple of learning; but, at preſent, denotes that ſcience which teaches, or contemplates, whatever is capable of being numbered or meaſured, in ſo far as being computable or meaſurable; and accordingly is ſubdivided into arithmetic, which has numbers for its object, and geometry, which treats of magnitude.

MATHEMATICS are commonly diſtinguiſhed into pure and ſpeculative, which conſider quantity abſtractedly; and mixed, which treat of magnitude as ſubſiſting in material bodies, and conſequently are interwoven every where with phyſical conſiderations.

Mixed MATHEMATICS are very comprehenſive, ſince to them may be referred aſtronomy, optics, geography, hydrography, hydroſtatics, mechanics, fortification, gunnery, projectiles, mining, engineering, and navigation.

Pure mathematics have one peculiar advantage, that they occaſion no diſputes among wrangling diſputants, as in other branches of knowledge; and the reaſon is, becauſe the definitions of the terms are premiſed, and every one that reads a propoſition has the ſame idea of every part of it. Hence it is eaſy to put an end to all mathematical controverſies, by ſhowing, that our adverſary has not ſtuck to his definitions, or has not laid down true premiſes, or elſe that he has drawn falſe concluſions from true principles; and, in caſe we are able to do neither of theſe, we muſt acknowledge the truth of what he has proved.

It is true, that in mixed mathematics, where we reaſon mathematically upon phyſical ſubjects, we cannot give ſuch juſt definitions as the geometricians: we muſt therefore reſt content with deſcriptions; and they will be of the ſame uſe as definitions, provided we are conſiſtent with ourſelves, and always mean the ſame thing by theſe terms we have once explained.

Dr. Barrow gives a moſt elegant deſcription of the exellence and uſefulneſs of mathematical knowledge, in his inaugural oration, upon being appointed profeſſor of mathematics at Cambridge.

The mathematics, he obſerves, effectually exerciſe, not vainly delude, nor vexatiouſly torment ſtudious minds with obſcure ſubtleties; but plainly demonſtrate every thing within their reach, draw certain concluſions, inſtruct by profitable rules, and unfold pleaſant queſtions. Theſe diſciplines likewiſe inure and corroborate the mind to conſtant diligence in ſtudy; they wholly deliver us from a credulous ſimplicity, moſt ſtrongly fortify us againſt the vanity of ſcepticiſm, effectually reſtrain us from a raſh preſumption, moſt eaſily incline us to a due aſſent, perfectly ſubject us to the government of right reaſon. While the mind is abſtracted and elevated from ſenſible matter, diſtinctly views pure forms, conceives the beauty of ideas, and inveſtigates the harmony of proportions; the manners themſelves are ſenſibly corrected and improved, the affections compoſed and rectified, the fancy calmed and ſettled, and the underſtanding raiſed and excited to more divine contemplations.

MATROSSES, are properly apprentices to the gunner, being ſoldiers in the royal regiment of artillery, and next to them: they aſſiſt in loading, firing, and ſpunging the great guns. They carry firelocks, and march along with the guns and ſtore-waggons, both as a guard, and to give their aſſiſtance on every emergency.

MATTUCASHLASH, an ancient Scotch weapon, ſometimes called arm-pit dagger, was worn there, ready to be uſed on coming to cloſe quarters. This, with a piſtol ſtuck in the the girdle, completely armed the highlanders.

MAXIMS, in *fortification*. See FORTIFICATION.

MEASURE, in *geometry*, any quantity aſſumed as one, to which the ratio of other homogeneous or ſimilar quantities is expreſſed.

MEASURE *of an angle*, the length of an arch deſcribed from the vertex to any place between its legs: hence angles are diſtinguiſhed by the ratio of the arches between the legs to the peripheries. See ANGLE.

MEASURE *of a figure*, is a ſquare, whoſe ſide is an inch, foot, yard, or other determinate meaſure. Hence ſquare meaſures.

Among geometricians it is uſually a ſquare rod called *decempeda*, divided into 10 ſquare feet, and thoſe into ſquare digits, and thoſe again into 10 lines, &c.

MEASURE *of a line*, any right line taken at pleaſure, and conſidered as unity.

MEASURE *of the maſs or quantity of matter*, in *mechanics*, is its weight; it being apparent that all the matter which coheres with a body, gravitates with it; and it being found by experiment, that the gravities of homogeneal bodies are in proportion to their bulks: hence, while the maſs continues the ſame, the abſolute weight will be the ſame, whatever figure it puts on; for as to its ſpecific weight, it varies as the quantity of its ſurface does.

MEASURE *of a number*, in *arithmetic*, ſuch a number as divides another without leaving a fraction: thus 9 is a meaſure of 27.

MEASURE *of a ſolid*, is a cube, whoſe ſide is an inch, foot, yard, or other determinate length: in geometry, it is a cubic perch, divided into cubic feet, digits, &c. Hence cubic meaſure or meaſures of capacity.

MEASURE *of velocity*, in *projectiles* and *mechanics*, the ſpace paſſed over by a moving body in any given time. The ſpace therefore muſt be divided into as many equal parts, as the time is conceived to be divided into: the quantity of ſpace anſwering to ſuch an article of time, is the meaſure of the velocity.

Meaſures then are various, according to the different kinds and dimenſions of things meaſured. Hence ariſe lineal and longitudinal meaſure for lines or lengths; ſquare, for areas; and ſolid or cubic, for bodies and their capacities: all which again are very different in different countries and ages, and even many of them for different commodities. Hence alſo ariſe other diviſions, of domeſtic and foreign, ancient and modern, dry and wet (or liquid) meaſures, &c.

Long MEASURE. The Engliſh ſtandard long meaſure, or that whereby the quantities of things are ordinarily eſtimated, is the yard, containing 3 Engliſh feet, equal to 3 Paris feet 1 inch and 3-12ths of an inch, or 7-9ths of a Paris ell. Its ſubdiviſions are the foot, ſpan, palm, inch, and barley-corn: its multipliers are the pace, fathom, pole, furlong, and mile.

French ſtandard MEASURE is the aune or ell, containing 3 Paris feet, 7 inches, 8 lines, or 1 yard 2-7ths Engliſh; the Paris foot royal exceeding the Engliſh by $\frac{68}{1000}$ parts: this ell is divided two ways; namely, into halves, thirds, ſixths, and twelfths; and into quarters, half-quarters, and ſixteenths. This ell obtains in the greateſt part of France, excepting at Troyes, Ares, and ſome parts of Picardy and Burgundy, where the ell is no more than 2 feet, 5 inches, 1 line; and at St. Genoux, where it exceeds the Paris ell by 8 lines: but at Marſeilles, Montpellier, Tholouſe in Provence, and Guinne, it contains 5 Paris feet, 5 inches, and 6 lines, or a Paris ell and a half: at Montpellier and the lower Languedoc, in Provence, Avignon, and even Dauphiné, it is a Paris ell and two thirds.

The Engliſh foot, to the French royal, is as 107 to 114; and the French toiſe is equal to 6 feet Engliſh, nearly.

Standard MEASURE, in Holland, Flanders, Sweden, a good part of Germany, many of the Hans-towns, Dantzig, and Hambourg, and at Geneva, Frankfort, &c. is likewiſe the ell, being different in all theſe parts: in Holland it contains 1 Paris foot, 11 lines, and 4-7ths of the Paris ell: the Flanders ell contains 7-12ths of the Paris ell: the ell of Germany and Brabant, &c. is equal to that of Flanders.

Italian MEASURE, is the braccio, or fathom; which obtains in the ſtates of Modena, Venice, Florence, Lucca, Milan, Mantua, Bologna, &c. At Venice it contains 1 Paris foot, 11 inches, 3 lines, or 8-15ths of the Paris ell: at Bologna, Modena, and Mantua, the ſame as at Venice: at Lucca it contains $\frac{1}{2}$ a Paris ell; at Florence, $\frac{40}{100}$ of a Paris ell: at Milan the brace for ſilks is 4-9ths of a Paris ell; and that for woollen cloths, the ſame as in Holland: at Bergama the brace is 5-9ths of a Paris ell. The uſual meaſure at Naples is the canna, containing $1\frac{15}{17}$ of a Paris ell.

Spaniſh MEASURE, is the vara, containing $\frac{17}{24}$ of the Paris ell: but in Caſtile and Valentia, the meaſure is the pau, ſpan, or palm; which is uſed, with the canna, at Genoa. In Arragon, the vara is equal to a Paris ell and a half.

Portugueze MEASURE, is the covodo, containing 4-7ths of the Paris ell; and the vara, of which 106 make 100 Paris ells.

Piedmonteſe **Measure**, is the covedos, containing 4-7ths of the Paris ell. In Sicily the meaſure is the canna, the ſame with that of Naples.

Muſcovite **Measures**, are the cubit, equal to 1 Paris foot, 4 inches, 2 lines; and the arcin, 2 whereof are equal to 3 cubits.

Turkiſh and Levant **Measures**, are the picq, containing 3-5ths of the Paris ell. The Chineſe meaſure is the cobre, 10 of which are equal to 3 Paris ells. In Perſia, and ſome parts of the Indies, the gueze, of which there are two kinds; the royal gueze, or gueze monkelſer, containing 4-5ths of the Paris ell; and the ſhorter gueze, only 2-3ds of the former. At Goa and Ormus, the meaſure is the Portugueſe vara. In Pegu, and other parts of the Indies, the cando, equal to the Venice ell. At Goa, and other parts, they uſe a larger cando, equal to 17 Dutch ells. In Siam they uſe the ken, ſhort of 3 Paris feet by an inch: the ken contains 2 ſocks, the ſock 2 keubs, the keub 12 nions or inches: the nion is equal to 8 grains of rice, that is, about 9 lines. At Camboia, the haſter; in Japan, the tatam; and the ſpan on ſome of the coaſts of Guinea.

Engliſh *Long* Measure.

inch												
3	palm											
9	3	ſpan										
12	4	1⅓	foot									
18	6	2	1½	cubit								
36	12	4	3	2	yard							
45	15	5	3¾	2½	1¼	ell						
60	20	6⅔	5	3⅓	1⅔	1⅓	pace					
72	24	8	6	4	2	1⅗	1⅕	fathom				
198	66	22	16½	11	5½	4	3$\frac{3}{10}$	2¾	pole			
7920	2640	880	660	440	220	176	132	110	40	furlong		
63360	21120	7040	5280	3520	1760	1408	1056	880	320	8	mile	

Jewiſh *Long or Itinerary* Measures.

						Eng. miles.	*paces.*	*feet. dec.*
cubic						0	0	1.824
400	ſtadium					0	145	4.6
2000	5	Sab. day's journey				0	729	3.0
4000	10	2	eaſtern mile			1	403	1.0
12000	30	6	3	paraſang		4	153	3.0
96000	240	48	24	8	a day's journey	33	172	4.0

Roman

Roman *long* MEASURE, *deduced to Engliſh.*

										paces.	feet	inch. dec.
digitus tranſverſus										0	0	0.725¼
1¾	uncia									0	0	0.967
4	3	palmus minor								0	0	2.901
16	12	4	pes							0	0	11.604
20	15	5	1¼	palmipes						0	1	2.505
24	18	6	1½	1⅕	cubitus					0	1	5.406
40	30	10	2½	2	1⅔	gradus				0	1	5.01
80	60	20	5	4	3⅓	2	paſſus			0	4	10.02
10000	7500	2500	625	500	416⅔	250	215	ſtadium		120	4	4.5
80000	60000	20000	5000	4000	3333⅓	2000	1000	8	milliare	967	0	0

Proportions of the long MEASURES *of ſeveral nations to the Engliſh foot.*

The Engliſh ſtandard foot being divided into 1000 equal parts, the other meaſures will have the proportions to it, which follow.

The	Engliſh foot from the ſtandard at Guild-hall	1000
	Paris royal foot, in the Chatelet	1068
	Rhinland foot of Snellius	1033
	Greek foot	$1007\frac{29}{100}$
	Roman foot on the monument of Coſſutius	967
	Roman foot of Villalpandus, taken from the congius of Veſpaſian	986
	Venetian foot	1162
	ell of Amſterdam	2268
	Amſterdam foot	942
	ell of Antwerp	2283
	foot of Antwerp	946
	ell of Leyden, in Holland	2260
	canna of Naples	6880
	vara of Almeria, and Gibraltar, in Spain	2760
	Spaniſh foot	1001
	Toledo foot	899
	braccio of Florence	1913
	palm of Genoa	815
	common braccio of Sienna	1242
	braccio of Sienna for linen	1974
	palm of the architects at Rome, whereof 10 make the canna of the ſame architects	732
	palm of the braccio for the merchants and weavers at Rome, from a marble in the Capitol, with this inſcription, CURANTE LV POETO	995½
	large pique of the Turks at Conſtantinople	2200
	ſmall pique of the Turks at Conſtantinople is to the larger as 31 to 32	
	ariſh of Perſia	3197
	derah or cubit of the Egyptians	1824
The	Dort foot in Holland	1184
	Middleburg foot	991
	Straſbourg foot	920
	Bremen foot	964
	foot of Cologn	954
	foot of Frankfort on the Main	948
	Dantzick foot	944
	foot of Copenhagen	965
	foot of Prague	1026
	Riga foot	1831
	Mantua	1585
	Bononia	1204
	foot of Mechlin	919
	Stockholm	963½
	Liſbon	1005

Engliſh ſquare or ſuperficial MEASURES, are raiſed from the yard of 36 inches multiplied into itſelf; and this producing 1296 ſquare inches in the ſquare yard, the diviſions of this are ſquare feet and inches, and the multipliers, poles, roods, and acres.

English *ſquare* MEASURE.

inches						
144	feet					
1296	9	yards				
3600	25	2	paces			
39204	272¼	30¼	10,89	poles		
1568160	10890	1210	435,6	40	roods	
6272640	43560	4840	1743,6	160	4	acr.

French ſquare MEASURES, are regulated by 12 ſquare lines in the inch ſquare, 12 inches in the foot, 22 feet in the perch, and 100 perches in the arpent or acre.

Cubical MEASURES, or meaſures of capacity for liquors. Engliſh liquid meaſures were originally raiſed from troy weight, it being ordained that 8 pounds troy of wheat, gathered from the middle of the ear, and well dried, ſhould weigh a gallon of wine meaſure; yet a new weight, viz. the avoirdupoiſe weight, has been introduced, to which a ſecond ſtandard gallon is adjuſted, exceeding the former in the proportion of the avoirdupoiſe weight to the troy weight. From this latter ſtandard are raiſed 2 meaſures, the one for ale, the other for beer.

The ſealed gallon at Guildhall, which is the ſtandard for wine, ſpirits, oil, &c. is ſuppoſed to contain 231 cubic inches; yet, by actual experiment made in 1688, before the lord mayor and commiſſioners of exciſe, it only contains 224 cubic inches. It was however agreed to continue the common ſuppoſed contents of 231: hence, as 12 : 231 :: $14\frac{12}{20}$: 281½, the cubic inches in an ale gallon; but, in effect, the ale quart contains 70½ cubic inches; on which principles, the ale and beer gallon will be 282 cubic inches.

Dry MEASURE, is different from both the ale and wine meaſure, being nearly a mean between both.

According to an act of parliament paſſed in 1697, every round buſhel with a plain and even bottom, being made 18½ inches throughout, and 8 inches deep, is to be accounted a legal Wincheſter buſhel, according to the ſtandard in his majeſty's exchequer; conſequently a corn gallon will contain 268.8 inches, as in the following table.

inches				
2688	gallons			
5376	2	pecks		
21504	8	4½	buſhels	
172032	64	32	8	quarters

MEASURE *of wood for firing*, is the cord, being 4 feet high, as many broad, and 8 long: it is divided into 2 half-cords.

MEASURE *for horſes*, is the hand, which by ſtatute contains 4 inches.

Powder MEASURES, made of copper, holding from an ounce to 12 pounds, are very convenient in a ſiege, when guns or mortars are loaded with looſe powder, eſpecially in ricochet-firing, &c.

As powder meaſures are uſeful in artillery, being more handy than weights, ſaving time, &c. we ſhall inſert here ſome experiments made by profeſſor Muller upon that ſubject, in 1753, at the royal military academy at Woolwich.

1. A cylinder, whoſe axis and diameter were 2 inches each, contained 3 ounces and 3 grains, or 51 grains; and as ſimilar cylinders are as the cubes of their axes, we ſay 51 grains are to 256 grains, or 1 pound, as the cube 8 of 2 inches is to the cube 40.156 of the diameter of a like cylinder holding 1 pound.

2. A cylinder, whoſe axis and diameter were 4 inches each, held 25 ounces and 10.5 grains, or 410.5 grains: whence 410.5 grains are to 256 grains, as the cube 64 of 4 inches is to 39.912, the cube of the axis of a cylinder holding 1 pound.

3. A cylinder, whoſe diameter and axis were 6 inches each, held 5 pounds 6 ounces and 6 grains, or 1382 grains: hence 1382 : 256 :: 216 : 40.01 for the cube required.

4. A two-inch cube held 4 ounces and 1 grain, or 65 grains: and as 452 is to 355, ſo is the cube 8 of the axis to the content of the cylinder, which therefore is 51.05 : hence 65 : 256 :: 8 : 40.117, the cube of the axis.

5. A ſix-inch cube held 6 pounds 13 ounces and 13 grains, or 1757 grains: ſo then 452 : 355 :: 1757 : 1379.944, or 1380, the content of the cylinder: and if 1380 : 256 :: 216 : 40.07, this 4th term will be the cube of the

axis required. Hence a medium of theſe 5 experiments gives 40.053 cubic inches, whoſe cube root 3.42 will be the diameter of a cylinder holding a pound of powder.

Diameters and heights of cylindric Powder MEASURES *from* 1 *to* 39 *ounces.*

℥	0	1	2	3	4	5	6	7	8	9
0	0	1.357	1.710	1.957	2.154	2.321	2.467	2.596	2.714	2.830
1	2.924	2.963	3.107	3.191	3.271	3.347	3.420	3.490	3.575	3.622
2	3.684	3.744	3.803	3.859	3.915	3.968	4.021	4.072	4.121	4.170
3	4.217	4.263	4.309	4.353	4.397	4.439	4.481	4.523	4.563	4.603

N. B. The logarithm of an ounce is .1326467: the other numbers are found by adding ⅓ of the number of the logarithm of the number of ounces: thus the number of 8 ounces is found by adding .3010300, ⅓ of the logarithm of 8 to that of 1 ounce, which gives .4336767 for the logarithm of the number ſought, which therefore is 2.714. See the above table.

Diameters and heights of cylindric Powder MEASURES *from* 1 *to* 39 *pounds.*

℔	0	1	2	3	4	5	6	7	8	9
0	0	3.420	4.309	4.932	5.429	5.848	6.214	6.541	6.824	7.114
1	7.368	7.606	7.830	8.041	8.243	8.434	8.618	8.794	8.963	9.126
2	9.283	9.435	9.583	9.726	9.865	10.00	10.13	10.26	10.38	10.51
3	10.63	10.74	10.86	10.97	11.08	11.16	11.29	11.45	11.50	11.60

Diameters of cylindric Powder MEASURES, *when the diameter is to the axis as* 2 *to* 3.

℥	0	1	2	3	4	5	6	7	8	9
0	0	1.181	1.491	1.710	1.880	2.027	2. 55	2.268	2.371	2.472
1	2.554	2.588	2.714	2.788	2. 57	2.92	2.988	3.049	3.164	3.184
2	3.218	3.271	3.322	3.371	3.420	3.466	3.513	3.557	3.600	3.643
3	3.684	3.724	3.764	3.802	3.841	3.878	3.915	3.951	3.986	4.021

℔	0	1	2	3	4	5	6	7	8	9
0	0	2.988	3.764	4.308	4.743	5.109	5.428	5.714	5.961	6.215
1	6.436	6.644	6.840	7.024	7.201	7.368	7.529	7.682	7.830	7.972
2	8.109	8.242	8.372	8.496	8.618	8.736	8.849	8.963	9.068	9.181
3	9.286	9.382	9.496	9.583	9.679	9.769	9.769	9.863	10.00	10.13

Theſe diameters are found, if thoſe of the former tables be divided by 1.1447, the cube root of 3-2ds.

Measure-*angle*, a braſs inſtrument to meaſure angles, either ſalient or rentrant, for exactly aſcertaining the number of degrees and minutes, to delineate them on paper.

MEASURING, }
MENSURATION, } in *military mathematics*, the aſſuming any certain quantity, and expreſſing the proportion of other ſimilar quantities to the ſame; or the determining, by a certain known meaſure, the preciſe extent, quantity, or capacity of any thing.

Measuring, in *general*, conſtitutes the practical part of geometry: and from the various ſubjects about which it is converſant, it acquires various names, and conſtitutes various arts, viz.

See Longimetry, Altimetry, Levelling, Geodesia, or Surveying, Steriometry, Superficies and Solids, &c.

Measuring. See Chain.

MECHANICS, a mixed mathematical ſcience, which conſiders motion and moving powers, their nature and laws, with the effects thereof, in machines, &c. The word is derived from the Greek μηχανικὴ, which ſignifies the ſame thing, and derived from μηχανὴ, an inſtrument or ſkill. That part which conſiders motion ariſing from gravity, is ſometimes called ſtatics, in contradiſtinction from that part which conſiders the mechanical powers and their application, properly called mechanics.

MECHANICAL, ſomething relating to mechanics.

Mechanical *philoſophy*, that which explains the phænomena of nature, and the operations of corporeal things, on the principles of mechanics; namely, the motion, gravity, figure, arrangement, &c. of the parts which compoſe natural bodies.

Mechanical *powers*, or *machines*, are 6 in number, viz. the lever, the pully, the wheel and axle, the inclined plane, the wedge and the ſcrew.

They are called mechanical powers, becauſe they increaſe our power of moving or raiſing heavy bodies, which are often unmanageable by any human ſtrength, not thus aſſiſted; and of two or more of theſe all other compound machines are compoſed.

As the learned Dr. Hamilton, profeſſor of mathematics in the univerſity of Dublin, has lately publiſhed a new theory of the mechanical powers, and diſplayed the principles on which we may beſt explain their nature and manner of acting; we ſhall lay before our readers the ſubſtance of his ingenious eſſay in his own words.

" The many uſeful inſtruments, ſays this able mathematician, that have been ſo ingeniouſly invented, and ſo ſucceſsfully executed, and the great perfection to which the mechanic arts are now arrived, would naturally incline one to think that the true principles on which the efficacy and operations of the ſeveral machines depend, muſt long ſince have been accurately explained. But this is by no means a neceſſary inference; for, however men may differ in their opinions about the true method of accounting for the effects of the ſeveral machines, yet the practical principles of mechanics are ſo perfecty known by experience and obſervation, that the artiſt is thereby enabled to contrive and adjuſt the movements of his engines with as much certainty and ſucceſs as he could do, were he thoroughly acquainted with the laws of motion, from which theſe principles may be ultimately derived. However, though an enquiry into the true method of deducing the practical principles of mechanics from the laws of motion, ſhould perhaps not contribute much to promote the progreſs of the mechanic arts, yet it is an enquiry in itſelf uſeful, and in ſome meaſure neceſſary; for, ſince late authors have uſed very different methods of treating this ſcience, it may be ſuppoſed that no one method has been looked upon as ſatisfactory, and unexceptionable. I ſhall therefore wiſh to contribute towards having this ſubject treated with more accuracy than has hitherto been done.

" The moſt general and remarkable theorem in mechanics is certainly this: that when two weights, by means of a machine, counterpoiſe each other, and are then made to move together, their quantities of motion will be equal. Now, an equilibrium always accompanying this equality of motions, bears ſuch a reſemblance to the caſe wherein two moving bodies ſtop each other, that Dr. Wallis, and after him moſt of the late writers, have thought the cauſe of an equilibrium in the ſeveral machines might be immediately aſſigned, by ſaying, that ſince one body cannot produce in another a quantity of motion equal to its own, without loſing its own at the ſame time; two heavy bodies counteracting each other by means of a machine muſt continue at reſt, when they are ſo circumſtanced that one cannot deſcend without cauſing the other to aſcend at the ſame time, and with the ſame quantity of motion; and, therefore, two heavy bodies, in ſuch caſes, muſt always counterbalance each other. Now this argument would be a juſt one, if it could properly be ſaid that the motion of the aſcending body was produced by that of the deſcending one; but, ſince the bodies are ſo connected that one cannot poſſibly begin to move before the other, I apprehend, that, if bodies are ſuppoſed to move, it cannot be ſaid that the motion of one is produced by that of the other: ſince whatſoever force is ſuppoſed to move, one muſt be the immediate cauſe of motion in the other alſo; that is, both their motions muſt be ſimultaneous effects of the ſame cauſe, juſt as if the two bodies were really but one: and, therefore, if I was to ſuppoſe, in this caſe, that the ſuperior weight of the heavier body (which may be in itſelf much more than able to ſuſtain the lighter) ſhould overcome the weight of the lighter, and produce equal motions in both bodies; I do not think that from thence I could be reduced to the abſurdity of ſuppoſing, that one body, by its motion, might produce in another a motion equal to its own, and yet not loſe its own at the ſame time. But thoſe who argue from the equality of motions on this occaſion ſay further, that, ſince the two bodies muſt have equal motion when they do move, they muſt have equal endeavours to move even while at reſt, and therefore theſe endeavours to move, being equal and contrary, muſt deſtroy each other, and the bodies muſt continue at reſt, and conſequently balance each other. In anſwer to this I muſt obſerve, that the abſolute force with which a heavy body endeavours to deſcend from a ſtate of reſt, can only be proportionable to its weight; and therefore I think it is neceſſary, that ſome cauſe ſhould be aſſigned why (for inſtance in the lever) the endeavour of one pound to deſcend ſhall be equal to that of 4 pounds; and eſpecially as the fulcrum on which both weights act requires no greater force to ſupport it than that of 5 pounds.

" From theſe conſiderations I infer, that the reaſon why very unequal weights may balance each other, ſhould be aſſigned not from their having momenta when made to move together, but by proving *à priori*, without conſidering their motions, that either the re-action of the fixed parts of the machine, or ſome other cauſe, ſo far takes off from the weight of the heavier body as to leave it only juſt able to ſupport the lighter. However, as this equality of momenta which always accompanies an equilibrium, affords a very elegant theorem, it ſhould be taken notice of in every treatiſe of mechanics, and may ſerve as an index of an equilibrium. But I would not have it applied to a purpoſe for which it is unfit; as it has in another inſtance by Dr. Kiel, who from thence gives the reaſon why water ſtands at the ſame height in a narrow tube and a wide veſſel with which it communicates: and an argument of the ſame kind is applied ſtill more improperly by Dr. Rutherforth, and others, to ſhew why a drop of water included in a ſmall conical tube will move towards the narrower end: and yet the true ways of accounting for both theſe phænomena are extremely obvious and eaſy.

" The ſimple mechanic powers are uſually reckoned 6, the lever, axle and wheel, pully, wedge, inclined plane, and ſcrew. The only method I have met with of explaining the nature of theſe machines upon one and the ſame principle, is that which I juſt now examined; and as that appears to me unſatisfactory, I ſhall conſider the nature of each machine ſeparately, in the order I have ſet them down.

" The lever is ſaid to be a right line, inflexible and void of weight. Its fundamental property is this: when any two forces act againſt each other on the arms of a lever, they will continue in equilibrio, if their quantities are inverſely as the diſtances between the points to which they are applied and the point round which the lever turns; which point is called the fulcrum, or prop.

" Several methods have been uſed, by different authors, to prove, that this property belongs to the lever. We find in the works of Archimedes, a proof brought for this purpoſe, which has ſince been made uſe of by ſeveral writers of mechanics; who, I find, have ſomewhat altered the form of his argument, the ſubject of which is generally expreſſed as follows: When a cylinder of any uniform matter is ſupported at its middle point, it will continue at reſt; for all the parts on one ſide muſt balance thoſe on the other, being exactly equal to them both in weight and ſituation; ſo that the whole weight of this cylinder may be looked upon as acting on the middle point on which it is ſupported. From whence it follows, that the weight of ſuch a cylinder will act upon whatever ſupports it, in the ſame manner as it would do if it was all contracted into the middle point of its axis. If therefore we ſuppoſe the cylinder to be diſtinguiſhed into two unequal cylinders or ſegments, the diſtances between the middle points of thoſe ſegments and the middle of the whole cylinder will be inverſely as the lengths of the ſegments; that is, inverſely as their weights: but, as it was ſaid before, the weight of each cylinder acts in the ſame manner as it would do if contracted into the middle point of its axis; and therefore if the weights of thoſe cylinders be contracted into theſe points, they will continue to ſupport each other as before: and thence it is concluded, that any two weights, acting againſt each other on a line ſuſtained at a fixed point, will counterpoiſe each other, when they are inverſely as the diſtances of the points on which they act, from the point on which the line reſts. To this agreement there ſeems to be a manifeſt objection; for, when the whole cylinder is diſtinguiſhed into two ſegments, part of the weight of the greater ſegment acts on the ſame ſide of the fulcrum with the leſſer ſegment; and therefore when the whole weight of the greater ſegment is contracted into its middle point on one ſide of the fulcrum, and acts all of it againſt the leſſer ſegment, it requires at leaſt ſome proof to ſhew, that this contracted weight will be balanced by the weight of the leſſer ſegment. Mr. Hugens, in his miſcellaneous obſervations on mechanics, takes notice of this objection to Archimedes's method, which, he ſays, ſeveral mathematicians had endeavoured to remove, but without ſucceſs. He therefore, inſtead of this method, propoſed one of his own, which depends on a poſtulatum that he uſes in common with Archimedes, and which I think ſhould not be granted on this occaſion: it is this; when equal bodies are placed on the arms of a lever, the one which is furthermoſt from the fulcrum will prevail and raiſe the other up. Now, this is taking it for granted, in other words, that a ſmall weight placed further from the fulcrum will ſupport or raiſe a greater one. The cauſe and reaſon of which fact muſt be derived from the demonſtration that follows; and therefore this demonſtration ſhould not be founded on the ſuppoſed ſelf-evidence of what is partly the thing to be proved. But perhaps it may be ſaid, that the poſtulatum may be granted merely on this account; that the centre of gravity of the two bodies (which in this caſe is the middle point between them) is not ſuſtained; and therefore the body, which is on the ſame ſide of the fulcrum with the centre of gravity, will deſcend.

"In anſwer to which I muſt obſerve, that this property, which the centre of gravity has of deſcending, when not placed directly above or below the point of ſuſpenſion, cannot be proved to belong to it in any caſe; nor can we even ſhew that there is only one centre of gravity between two bodies joined by a right line, until it is proved in general that the centre of gravity of any two bodies is a point ſo placed between them, that their diſtances from it are inverſely as their weights: but this in effect includes the principal property of the lever, which therefore cannot be proved from any previous ſuppoſition, that the centre of gravity will deſcend, even when the bodies are equal, and we know it is the middle point between them.

"I muſt now proceed to conſider what Sir Iſaac Newton hath delivered on this ſubject in his *Principia*, after the 2d cor. to the 3d law of motion, which Dr. Clarke, (in his notes on Rohault) and all the ſubſequent writers, have quoted as an elegant proof of the property of the lever; and therefore what appears to me at preſent an objection to this proof, I ſhall mention with great diffidence, and in hopes of being ſet right, if I am wrong. Sir Iſaac ſuppoſes two weights, as *A* and *P* (pl. I. fig. 8*.) to hang by threads, from the points *M* and *N* in a wheel or circular plane perpendicular to the horizon, and moveable about its centre *O*; and then propoſes to determine the forces with which theſe weights act to turn the wheel round its centre. In order to do this, he ſuppoſes that it is indifferent from what points in the perpendicular lines *MA* and *NP* the weights are hung, for that they will ſtill have the ſame power to turn the wheel about its centre. His words are, *Quoniam nil refert utrum filorum puncta K, L, D, affixa ſint vel non affixa ad planum rotæ; pondera idem valebunt ac ſi ſuſpenderentur a punctis K et L, vel D et L.* Now whether the points of the threads *L*, *L*, *D*, are fixed or not to the plane of the wheel, is certainly of importance, as it muſt make a difference in the points of ſuſpenſion of the weights, and conſequently in the degrees of obliquity with which the weights act; for the loweſt point of the thread that is fixed to the plane muſt be conſidered as the point from which the weight hangs; as the parts of the thread above that point are quite uſeleſs, not being at all acted upon. And from thence I ſhall endeavour to ſhew, that to ſuppoſe the weight *A* will have the ſame power to turn the wheel from whatever point in the line *MA* it hangs, is in effect preſuppoſing what is intended to be proved. For it appears, from what he ſays immediately after, that, when the weight *A* hangs from the point *D*, if its whole force be expreſſed by the line

A D, and be reſolved into two forces, *D C* and *A C*, the former only will have any effect in turning the wheel, as it acts perpendicularly on the radius *O D*, while the latter is loſt, its direction being parallel to *O D*. But it is evident, that, when the ſame weight hangs from the point *K*, as it acts perpendicularly on the radius *O K*, its whole force is exerted to turn the wheel, and none of it loſt by oblique action.

" Therefore, the force which the weight *A*, exerts to oppoſe the weight *P*, and turn the wheel when it hangs from *D*, is, to the force it exerts when it hangs from *K*, as the line *D C* to *A D*, or as *O K* to *O D*, (ſim. triang. *A D C*, *D O K*) that is, the forces exerted by the weight *A*, hanging from the points *D* and *K*, are inverſely as the radii *O D* and *O K*. And therefore to ſuppoſe, that theſe two forces will have the ſame effect in turning the wheel and oppoſing the weight *P*, is the ſame as ſuppoſing that two forces will have equal effects in moving the arms of a lever (on which they act perpendicularly) when they are inverſely at the lengths of thoſe arms. But this is the very concluſion Sir Iſaac draws from his premiſes; for he ſays, *Pondera igitur A et P, quæ ſunt reciproce ut radii in directum poſiti O K, O L, idem pollebunt et ſic conſiſtent in æquilibrio, quæ eſt proprietas notiſſima libræ, vectis et axis in peritrochio.* But further, this property of the lever, which is here expreſſed in general terms, includes two caſes; for the arms of the lever may be either perpendicular or oblique to the directions of the weights. The firſt of theſe caſes is the ſimpleſt, and ſhould be firſt demonſtrated: and I do not ſee how there can be any room for applying the reſolution of forces in demonſtrating this caſe, in which no part of any weight is loſt by oblique action. But when this caſe is proved, we have from thence, by the reſolution of forces, an eaſy way of ſhewing, in the ſecond caſe, when the arms of the lever are oblique to the directions of the weights, that the weights will counterbalance each other, when they are reciprocally as the perpendicular diſtances of their lines of direction from the centre of motion. From the laſt of theſe caſes, we may deduce an obvious reaſon why the weight *A* ſhould have the ſame power to turn the wheel, from whatever point it hangs in the line *M A*; the truth of which, I am perſuaded, cannot be proved independent of thoſe caſes, and therefore think it ſhould not be uſed as a poſtulatum in demonſtrating the general property of the lever.

" Mr. Maclaurin, in his view of Newton's Philoſophy, after giving us the methods which Archimedes and Newton have uſed for proving the fundamental property of the lever, propoſes one of his own, which, he ſays, appears to be the moſt natural one for this purpoſe. However, as to his method I ſhall only obſerve, that, from equal bodies ſuſtaining each other at equal diſtances from the fulcrum, he ſhews us how to infer that a body of one pound (for inſtance) will ſuſtain another of two pounds at half its diſtance from the fulcrum; and from thence that it will ſuſtain one of three pounds at a third of its diſtance from the fulcrum: he goes on, declaring, by a kind of induction, what the proportion is in general between two bodies that ſuſtain each other on the arms of the lever. But this argument, he obſerves, cannot be applied when the arms of the lever are incommenſurable; and therefore it cannot conclude generally, and conſequently is imperfect.

" Theſe are the methods of demonſtrating the fundamental property of the lever, which are worth taking notice of; and, ſince they ſeem liable to exceptions, and the other methods I have met with are ſtill more exceptionable, I ſhall propoſe a new proof of this property of the lever, which appears to me a very ſimple one, and depends on a poſtulatum that, I believe, will be readily granted.

" If a force be univerſally diffuſed over a right line, that is, if an equal part of the force acts upon every point of the line, and if the whole force acts according to one and the ſame plane; this force will be ſuſtained, and the line kept in equilibrio, by a ſingle force applied to the middle point of the line equal to the diffuſed force, and acting in a contrary direction.

" In order to ſhorten the following proof, I muſt premiſe, by way of lemma, that, if a right line be divided into two ſegments, the diſtance between the middle of the whole line, and the middle points of the ſegments, will be inverſely as the ſegments. This is ſelf-evident when the ſegments are equal; and, when they are unequal, then, ſince half of the whole line is equal to half of the greater and half of the leſſer ſegment, it is plain that the diſtance between the middle of the whole line and the middle of one ſegment muſt be equal to half of the other ſegment, ſo that theſe diſtances muſt be to each other inverſely as the ſegments; all which appear evident from the inſpection of fig. 9.

" Let now the line *G H*, (fig. 10.) whoſe middle point is *D*, be divided into unequal ſegments *G L*, and *L H*, whoſe middle points are *C* and *F*, and let two forces or weights *A* and *B*, which are to each other as the ſegments *GL* and *LH*, be applied to their middle points *C* and *F*, and let them act perpendicularly on the line *GH*. Then (by the lemma) the weight *A* and *B* will be to each other inverſely as *CD*, and *FD*, (the diſtances of the points *C* and *F*, to which they are applied from the middle of the whole line): if then a third force or weight *E*, equal to the ſum of the forces *A* and *B*, be applied to the point *D*, and acts on the line in an oppoſite direction; I ſay, then, theſe three forces will ſuſtain each other, and keep the line in equilibrio. For let us ſuppoſe the force *E* to be removed, and inſtead of it another force, equal alſo to the ſum of *A* and *B*, to be uniformly diffuſed over the whole line *GH*, and to act directly againſt the forces *A* and *B*, then the part of this force which acts on the ſegment *GL*, will be equal to the force *A*, and therefore will be ſuſtained by it (*poſtulatum*); and the other part, which is diffuſed over the ſegment *LH*, will be equal to and ſuſtained by the force *B*, ſo that the forces *A* and *B* will ſuſtain this diffuſed force, and keep the line in equilibrio. Let now two other forces act alſo on this line in oppoſite directions, one of them the force *E* acting on the point *D*, as it was firſt ſuppoſed to do, and the other an uniformly diffuſed force equal to *E* (and conſequently equal to the other diffuſed force): then theſe two additional forces will alſo balance each other, and therefore the equilibrium will ſtill remain: ſo that the two forces *A* and *B*, and a diffuſed force acting on one ſide of the line, ſuſtain the force *E* and a diffuſed force acting on the other ſide: but it is manifeſt, that in this equilibrium, the two diffuſed forces acting on oppoſite ſides are perfectly equivalent; and therefore, if they are taken away from both ſides, the equilibrium muſt ſtill remain. Hence it appears, that the three weights or forces *A*, *B*, and *E*, any two of which are (by the conſtruction) to each other inverſely as their diſtances from the third, will ſuſtain each other, and keep the line on which they act in equilibrio; which is the firſt and moſt ſimple caſe of the property of the lever; for here the directions of the weights are ſuppoſed to be perpendicular to the line on which they act; and it is evident that, if one of the points *C*, *D*, or *F*, be fixed or conſidered as a fulcrum, the weights acting on the other two points will continue to ſupport each other.

“ I ſhall not now take the trouble of proving the ſecond caſe of the ſecond property of the lever: it is moſt eaſily deduced from the firſt; for when two weights act on the arms of a lever in oblique directions, and are to each other inverſely as the perpendicular diſtances of their lines of direction from the centre of motion, then, by the revolution of forces, it is eaſily proved that the parts of thoſe forces which act perpendicularly on the arms of the lever, and which only are exerted to turn the lever, are to each other inverſely as the lengths of thoſe arms; and therefore by the firſt caſe they muſt balance each other.

“ I ſhall now mention ſome well-known truths in mechanics, which, I think, cannot be proved otherwiſe than by deducing them from what hath been here demonſtrated.

“ *Corollary* 1. It appears from hence, that the powers with which any two forces move or endeavour to move the arms of a lever, are as the rectangles, under lines proportional to the forces, and the perpendicular diſtances of their lines of direction from the fulcrum.

“ *Cor.* 2. When therefore two bodies acting on the arms of a lever ſuſtain each other, if one of them be removed farther from the fulcrum, it will preponderate; but if it be brought nearer to the fulcrum, the other weight will prevail; becauſe the product to which its force is proportionable will be increaſed in the firſt caſe, and diminiſhed in the ſecond.

“ *Cor.* 3. We learn from hence to find out the centre of gravity of any two bodies joined by an inflexible right line, and to prove that its definition will agree to one point only in the line. For if a point be taken in the line, ſo that the diſtances of the bodies from it may be inverſely as their weights, that point will be the centre of gravity; becauſe, when it is ſuſtained, the bodies will be in equilibrio. But if the line is ſuſtained at any other point, then is the fulcrum removed further from one body, and brought nearer to the other, than it was when the bodies balanced each other; and therefore, by preceding *Cor.* that body from which it is removed, or which is on the ſame ſide with the centre of gravity, will deſcend: conſequently there is but one point in the line, which being ſuſtained, the bodies will be in equilibrio, and therefore but one point only can be their centre of gravity. Hence alſo it appears, that the centre of gravity will always deſcend, when it is not directly above or below the point by which the body is ſuſtained.

“ I ſhall now endeavour to be as conciſe as poſſible in what I have to ſay of the other mechanic powers; having, I fear, been too tedious in my account of the lever, which, however,

ever, deſerves to be particularly conſidered, ſince to it may be reduced the balance, the axle and wheel, and (according to ſome writers) the pully.

" The balance I do not conſider as a diſtinct machine, becauſe it is evidently no other than a lever fitted to the particular purpoſe of comparing weights together; and does not ſerve for raiſing weights, or overcoming reſiſtances, as the other machines do.

" When a weight is to be raiſed by means of an axle and wheel, it is faſtened to a cord that goes round the axle; and the power, which is to raiſe it, is hung to a cord that goes round the wheel. If then the power be to the weight as the radius of the axle to the radius of the wheel, it will juſt ſupport that weight; as will eaſily appear from what was proved of the lever. For the axle and wheel may be conſidered as a lever, whoſe fulcrum is a line paſſing through the centre of the wheel and middle of the axle, and whoſe long and ſhort arms are the radii of the wheel and axle, which are parallel to the horizon, and from whoſe extremities the cords hang perpendicularly. And thus an axle and wheel may be looked upon as a perpetual lever, on whoſe arms the power and weight always act perpendicularly, though the lever turns round its fulcrum. And in like manner, when wheels and axles move each other by means of teeth on their peripheries, ſuch a machine is really a perpetual compound lever: and, by conſidering it as ſuch, we may compute the proportion of any power to the weight it is able to ſuſtain by the help of ſuch an engine. And ſince the radii of two contiguous wheels, whoſe teeth are applied to each other, are as the number of teeth in each, or inverſely as the number of revolutions which they make in the ſame time; we may, in the computation, inſtead of the ratio of theſe radii, put the ratio of the number of teeth on each wheel, or the inverſe ratio of the number of revolutions they make in the ſame time.

" Some writers have thought the nature and effects of the pully might be beſt explained by conſidering a fixed pully as a lever of the firſt, and a moveable pully as one of the ſecond kind. But though the pully may bear being conſidered in that light, yet, I think, the beſt and moſt natural method of explaining its effects (that is, of computing the proportion of any power to the weight it can ſuſtain by means of any ſyſtem of pullies) is, by conſidering that every moveable pully hangs by two ropes, equally ſtretched, which muſt bear equal parts of the weight; and therefore, when one and the ſame rope goes round ſeveral fixed and moveable pullies, ſince all its parts on each ſide of the pullies are equally ſtretched, the whole weight muſt be divided equally amongſt all the ropes by which the moveable pullies hang: and conſequently, if the power which acts on one rope be equal to the weight divided by the number of ropes, or double the number of moveable pullies, that power muſt ſuſtain the weight.

" Upon this principle, the proportion of the power to the weight it ſuſtains by means of any ſyſtem of the pullies, may be computed in a manner ſo eaſy and natural as muſt be obvious to every common capacity.

" The proportion which any power bears to the reſiſting force it is able to ſuſtain by means of a wedge, has been laid down differently by different authors, as they happened to conſider it in particular caſes. Without examining their ſeveral opinions, I ſhall endeavour to expreſs this proportion in one general propoſition, which may extend to the ſeveral caſes in which the wedge is applied.

" Let the equicrural triangle ABC, (*fig.* 10.) repreſent a wedge: the lines AB and CB will be the ſides of the wedge, AC its baſe or back, and its height will be the line PB biſecting the baſe AC, and alſo the vertical angle ABC. When any two reſiſting forces act on the ſides of a wedge in directions which make equal angles with the ſides (as they are always ſuppoſed to do) a power acting perpendicularly at P, on the baſe of the wedge, will keep the reſiſting forces in equilibrio, when it is to the ſum of theſe forces, as the ſine of half the vertical angle of the wedge, to the ſine of the angle which the directions of the forces contain with the ſides of the wedge.

" For let E and F be two bodies acting on the ſides of the wedge, and let them be firſt ſuppoſed to act in the directions EP and FP perpendicular to the ſides; then ſince the power P acts perpendicularly on the baſe AC, if theſe three forces keep the wedge in equilibrio, they will be to each other as the ſides of a triangle, to which their directions are parallel, or (which is the ſame thing) as the ſides of the triangle ABC, to which their directions are perpendicular. Therefore the power P, is to the ſum of the reſiſting forces which it ſuſtains, as AC the baſe of the wedge to the ſum of the ſides, or as PA, ½ the baſe, to AB one of the ſides; but PA is to AB as the ſign of PBA, ½ the vertical angle of the wedge, to the radius which is the ſign of a right angle, and the directions of the reſiſting forces are ſuppoſed in this caſe to contain a right angle with the ſides of the wedge.

“ Let now the reſiſting bodies E and F be ſuppoſed to act on the wedge in directions parallel to the lines DP and OP, which make oblique angles with its ſides: draw EG and FK perpendicular to thoſe lines. From what has been proved it appears, that the power P is to the force with which it is able, by means of the wedge, to protrude the reſiſting bodies in the directions PE and PF, as the ſine of ½ the vertical angle to the radius: let this protruding force be expreſſed by the line PE, and let it be reſolved into two forces expreſſed by the lines PG and GE: the former of theſe only will act in oppoſition to the reſiſting bodies; therefore the whole protruding force of the power is, to the force with which it acts againſt the reſiſting bodies PE and PF in the directions PD and PO, as PE to PG, or (becauſe the triangles EPG and DPE are ſimilar) as PD to PE, that is, as the radius to the ſine of the angle PDE; compounding therefore the ratio of the ſine of ½ the vertical angle to the radius, with the ratio of the radius to the ſine of the angle PDE, the power P, when the wedge is kept in equilibrio, will be, to the force with which it protrudes the reſiſting bodies in directions oppoſite to thoſe in which they act, as the ſine of ½ the vertical angle to the ſine of the angle PDE or POE, which the directions of the reſiſting forces contain with the ſides of the wedge.

“ Hence, when the directions in which the reſiſting bodies act on a wedge are given, we may eaſily find two lines that will expreſs the proportion between the reſiſtance and the power which ſuſtains it by means of the wedge. For from P, the middle point of the wedge, draw the line PD meeting one of the ſides, and parallel to the direction in which the reſiſting force acts on that ſide, then the power will be to the reſiſtance as PD to PB, the height of the wedge. For PD and PB are to each other as the ſines of the oppoſite angles, in the triangle PBD, that is, as the ſines of ½ the vertical angle, and the angle which the direction of the reſiſting force contains with the ſides of the wedge.

“ From what hath been demonſtrated we may deduce the proportion of the power to the reſiſtance it is able to ſuſtain in all the caſes in which the wedge is applied. Firſt, when in cleaving timber the wedge fills the cleft, then the reſiſtance of the timber acts perpendicularly on the ſides of the wedge; therefore, on this caſe, when the power which drives the wedge, is to the coheſive force of the timber, as ½ the baſe to one ſide of the wedge, the power and reſiſtance will be in equilibrio.

“ Secondly, when the wedge does not exactly fill the cleft, which generally happens becauſe the wood ſplits to ſome diſtance before the wedge. Let ELF repreſent a cleft, into which the wedge ABC is partly driven: as the reſiſting force of the timber muſt act on the wedge in direction perpendicular to EL, the ſide of the cleft, and meeting the ſide of the wedge in D; then the power driving the wedge, and the reſiſtance of the timber, when they balance, will be to each other as the line PD to PB, the height of the wedge.

“ Thirdly, when a wedge is employed to ſeparate two bodies that lie together on an horizontal plane, for inſtance, two blocks of ſtone; as theſe bodies muſt recede from each other in horizontal directions, their reſiſtance muſt act on the wedge in lines parallel to its baſe CA; therefore the power that drives the wedge will balance the reſiſtance when they are to each other as PA, ½ the breadth of the wedge, to PB, its height; and then any additional force, ſufficient to overcome the reſiſtance ariſing from the friction of the bodies on the horizontal plane, will ſeparate them from each other.

“ The inclined plane is reckoned by ſome writers among the mechanic powers; and I think with reaſon, as it may be uſed with advantage in raiſing weights.

“ Let the line AB (*fig.* 11.) repreſent the length of an inclined plane, AD its height, and the line BD we may call its baſe. Let the circular body GEF be ſuppoſed to reſt on the inclined plane, and to be kept from falling down it by a ſtring CS tied to its centre C. Then the force with which this body ſtretches the ſtring will be to its whole weight, as the ſine of ABD, the angle of elevation, to the ſine of the angle which the ſtring contains with a line perpendicular to AB, the length of the plane. For let the radius CE be drawn perpendicular to AB, and from E draw EO parallel to the ſtring, and meeting CF in O; then, as the body continues at reſt, and is urged by three forces, to wit, by its weight in the direction CE, by the reaction of the plane in the direction EO; the reaction of the ſtring, or the force by which it is ſtretched, is to the weight of the body, as EO to CE; that is, as the ſine of (the angle ECO, which is equal to) ABD, the angle of elevation, to the ſine of the angle EOC, equal to SCO, the angle which the ſtring contains with the line CF perpendicular to AB, the length of the plane.

"When therefore the ſtring is parallel to the length of the plane, the force with which it is ſtretched, or with which the body tends down the inclined plane, is, to its whole weight, as the ſine of the angle of elevation, to the radius, or as the height of the plane to the length. And in the ſame manner it may be ſhewn, that when the ſtring is parallel to BD, the baſe of the plane, the force with which it is ſtretched is, to the weight of the body, as AD to BD; that is, as the height of the plane is to its baſe. If we ſuppoſe the ſtring, which ſupports the body GEF, to be faſtened at S, and that a force, by acting on the line AD, the height of the plane, and in a direction parallel to the baſe BD, drives the inclined plane under the body, and by that means makes it riſe to a direction parallel to AD: then, from what was proved in the third caſe of the wedge, it will appear, that this force muſt be to the weight of the body, as AD to BD, or rather in a proportion ſomewhat greater; if it makes the plane move on, and the body riſe.

"From this laſt obſervation we may clearly ſhew the nature and force of the ſcrew; a machine of great efficacy in raiſing weights, or in preſſing bodies cloſely together. For if the triangle ABD be turned round a cylinder whoſe periphery is equal to BD, then the length of the inclined plane BA will riſe round the cylinder in a ſpiral manner, and from what is called the thread of the ſcrew; and we may ſuppoſe it continued in the ſame manner round the cylinder from one end to the other; and AD the height of the inclined plane will be every where the diſtance between two contiguous threads of the ſcrew, which is called a convex ſcrew: and a concave ſcrew may be formed to fit this exactly, if an inclined plane, every way like the former, be turned round the inſide of a hollow cylinder, whoſe periphery is ſomewhat larger than that of the other. Let us now ſuppoſe the concave ſcrew to be fixed, and the convex one to be fitted into it, and a weight to be laid on the top of the convex ſcrew: then, if a power be applied to the periphery of this convex ſcrew to turn it round, at every revolution the weight will be raiſed up through a ſpace equal to the diſtance between the two contiguous threads; that is, to the line AD the height of the inclined plane BA; therefore, ſince the power applied to the periphery acts in a direction parallel to BD, it muſt be to the weight it raiſes as AD to BD, or as the diſtance between two contiguous threads, to the periphery of the convex ſcrew.

"The diſtance between two contiguous threads is to be meaſured by a line parallel to the axle. If we now ſuppoſe that a handſpike or handle, which is inſerted into the bottom of the convex ſcrew, and that the power which turns the ſcrew is applied to the extremity of this handle, which is generally the caſe; then, as the power is removed farther from the axis of motion, its force will be ſo much increaſed (*vide* what was ſaid of the lever, *Cor.* 1.) and therefore ſo much may the power itſelf be diminiſhed: ſo that the power, which, acting on the end of a handle, ſuſtains a weight by means of a ſcrew, will be to that weight, as the diſtance between two contiguous threads of the ſcrew, to the periphery deſcribed by the end of the handle. In this caſe we may conſider the machines as compoſed of a ſcrew and a lever, or, as Sir Iſaac Newton expreſſeth it, *Cuneus à vecte impulſus.*"

Of any two or more of theſe ſimple machines combined together, all other machines, however complicated, are compoſed; and their powers and manner of acting may thereby be explained from the principles here laid down.

Mechanical, in *mathematics*, denotes a conſtruction of ſome problem, by the aſſiſtance of inſtruments, as the duplicature of the cube, and quadrature of the circle, in contradiſtinction to that which is done in an accurate and geometrical manner.

MEDICINE-CHEST, is compoſed of all ſorts of medicines neceſſary for a campaign, together with ſuch chirurgical inſtruments as are uſeful, fitted up in cheſts, and portable.

MEMOIRS, in *military matters of literature*, a ſpecies of hiſtory, written by perſons who had ſome ſhare in the tranſactions they relate, anſwering, in ſome meaſure, to what the Romans call *commentarii*, i. e. commentaries.

MENSURATION, in *general*, denotes the act or art of meaſuring lines, ſuperficies and ſolids.

MERIT, in a *military ſenſe*, ſignifies promotion in the army according to merit, and not by purchaſe or intereſt.

MERLON, in *fortification*, that part of the parapet which is terminated by 2 embraſures of a battery, ſo that its height and thickneſs are the ſame with thoſe of the parapet. It ſerves to cover thoſe on the battery from the enemy, and is better when made of earth, well rammed and beat cloſe, than of ſtone, becauſe theſe fly about, and wound thoſe it ſhould defend.

MESS, in a *military ſenſe*, implies a number of ſoldiers who, by laying away a certain moiety of their pay towards proviſions, meſs together: 6 or 8 is generally the number of each meſs. Experience proves that nothing contributes more to the health of a ſoldier, than a regular and well-choſen diet, and his being obliged every day to boil the pot; it corrects drunkenneſs, and, in a great meaſure, prevents gaming, and thereby deſertion.

METAL, a hard, ſhining, mineral body, fuſible by fire, concreſcible by cold, ductile, and capable of being amalgamated or intimately united to quickſilver.

Gun-Metal, a compoſition of tin and copper. The moſt common proportion is, to 100 pounds of copper 12 pounds of tin: the founders will ſometimes vary from this proportion, according to the hardneſs of the copper.

MILE, in *geography*, a long meaſure, whereby the Engliſh, &c. uſe to expreſs the diſtance between places: it is of different extent in different countries. The geometrical mile contains 1000 geometrical paces, *mille paſſus*, from whence miles are denominated.

We ſhall here give a table of the miles in uſe among the principal nations of Europe, in geometrical paces, 60,000 of which make a degree of the equator.

		Geometrical paces
Mile of	Ruſſia	750
	Italy	1000
	England	1200
	Scotland and Ireland	1500
The	old league of France	1500
	ſmall league of France	2000
	great league of France	3000
Mile of	Poland	3000
	Spain and Portugal	3428
	Germany	4000
	Sweden	5000
	Denmark	5010
	Hungary	6000
	Holland	3500

MILITARY, ſomething belonging to the ſoldiery or militia, &c.

Military *architecture*, the ſame with fortification. See Fortification.

Military *ways*, the large Roman roads which Agrippa procured to be made through the empire in Auguſtus's time, for the marching of troops and conveying of carriages. They were paved from the gates of Rome to the utmoſt limits of the empire.

Military *diſcipline*. Next to the forming of troops, military diſcipline is the firſt object that preſents itſelf to our notice: it is the ſoul of all armies; and unleſs it be eſtabliſhed amongſt them with great prudence, and ſupported with unſhaken reſolution, they are no better than ſo many contemptible heaps of rabble, which are more dangerous to the very ſtate that maintains them, than even its declared enemies. See Discipline.

Military *execution*, the ravaging or deſtroying of a country or town that refuſes to pay the contribution inflicted upon them.

Military *firſt principles*, is the bodily training for a ſoldier, to make him hardy and robuſt, capable to maintain health amidſt fatigue, bad weather and change of climate; to march at ſuch poſſible pace, and for ſuch length of time, and with ſuch burden, as, without training, he would not be able to do.

MILITIA, in *general*, denotes the body of ſoldiers, or thoſe who make profeſſion of arms.

In a more reſtrained ſenſe, militia denotes the trained-bands of a town or country, who arm themſelves, upon a ſhort warning, for their own defence; ſo that, in this ſenſe, militia is oppoſed to regular or ſtated troops.

For the direction and command of the militia, the king conſtitutes lords-lieutenants of each county.

MILL, properly denotes a machine for grinding corn, &c. but more generally it denotes all ſuch machines whoſe action depends upon a circular motion. There are various kinds, though foreign to this work.

Gun-powder Mill, is that uſed for pounding and beating together the ingredients of which gunpowder is compoſed. See Gunpowder.

Theſe ingredients being duly proportioned, and put into the mortars of the mills, which are hollow pieces of wood, each capable of holding 20 pounds of paſte, are incorporated by means of the peſtle and ſpindle. There are 24 mortars in each mill, where are made each day 480 pounds of gunpowder, care being taken to ſprinkle the ingredients in the mortars with water, from time to time, leſt they ſhould take fire. The peſtle is a piece of wood 10 feet high, and 4½ inches broad, armed at bottom with a round piece of metal. It weighs about 65 pounds.

MINE, in a *military ſenſe*, implies a ſubterraneous paſſage dug under the wall or rampart of a fortification, with a deſign of blowing it up by gunpowder.

Counter-MINES, are thoſe made by the beſieged, whereas mines are generally made by the beſiegers. Both mines and counter-mines are made in the ſame manner, and for the like purpoſes, viz. to blow up their enemies and their works; only the principal galleries and mines of the beſieged, are uſually made before the town is beſieged, and frequently at the ſame time the fortification is built, to ſave expence.

MINING, in the *art of war*, is become one of the moſt eſſential parts of the attack and defence of places: ſo much artillery is uſed, that nothing above ground can withſtand its effects; the moſt ſubſtantial ramparts and parapets can reſiſt but a ſhort time; the outworks, though numerous, ſerve only to retard, for a time, the ſurrender of the place.

Hiſtory informs us that mines were made long before the invention of gunpowder; for the ancients made galleries or under-ground paſſages, much in the ſame way as the moderns, from without, under the walls of the places, which they cut off from the foundation, and ſupported them with ſtrong props: then they filled the intervals with all manner of combuſtibles, which being ſet on fire burnt their props, and the wall being no longer ſupported fell, whereby a breach was made.

The beſieged alſo made under-ground paſſages from the town under the beſieger's machines, by which they battered the walls, to deſtroy them; which proves neceſſity to be the inventor of mines, as well as of other uſeful arts.

The firſt mines, ſince the invention of gunpowder, were in 1487, by the Genoeſe, at the attack of Serezanella, a town in Florence; but theſe failing, they were for ſome time neglected, till Peter Navarro, being then engineer to the Genoeſe, and afterwards to the Spaniards in 1503, againſt the French, at the ſiege of the caſtle del Ovo, at Naples, made a mine under the wall, and blew it up, and the caſtle was taken by ſtorm.

Mr. Valliere relates the ſame ſtory, but differs in the name of the engineer: he ſays it was Francis George, an Italian, who, ſerving at Naples in quality of architect, propoſed to Peter Navarro, the Spaniſh governor, to take this caſtle by mines.

Definitions of MINES. A mine is a ſubterraneous cavity made according to the rules of art, in which a certain quantity of powder is lodged, which by its exploſion blows up the earth above it.

1. It has been found by experiments that the figure produced by the exploſion is a *paraboloid ABCD* (Pl. VII. *fig.* 6.) and that the centre of the powder, or charge, occupies the *focus F*.

2. The place where the powder is lodged is called the *chamber* of the mine, or fourneau.

3. The paſſage leading to the powder is called the *gallery*.

4. The line *FC* drawn from the centre *F* of the chamber, perpendicular to the neareſt ſurface *AB* of the ground, is called the line of leaſt reſiſtance.

5. The pit or hole *ADB*, made by ſpringing the mine, is called the *excavation*; alſo *AB* is the *diameter*, and *CB* the *radius* thereof.

6. The fire is communicated to the mines by a pipe or hoſe, made of coarſe cloth, whoſe diameter is about 1½ inch, called a *ſauciſſon*, (for the filling of which near half a pound of powder is allowed to every foot) extending from the chamber to the entrance of the gallery, to the end of which is fixed a match, that the miner who ſets fire to it may have time to retire, before it reaches the chamber.

7. To prevent the powder from contracting any dampneſs, the ſauciſſon is laid in a ſmall trough, called an *auget*, made of boards 3½ inches broad, joined together lengthwiſe, with ſtraw in it, and round the ſauciſſon, with a wooden cover nailed upon it.

Foyer,
Focus, or
Centre of the Chamber. } Some authors call the end of the ſauciſſon that comes within the work, and which is to be ſet fire to, the foyer, or focus; but by moſt people, this is generally underſtood to be the centre of the chamber.

Galleries and chambers of MINES. Galleries made within the fortification, before the place is attacked, and from which ſeveral branches are carried to different places, are generally 4 or 4½ feet wide, and 5 or 5½ feet high. The earth is ſupported from falling in by arches and walls, as they are to remain for a conſiderabl time; but when mines are made to be uſed in a ſhort time, then the galleries are but 3 or 3½ feet wide, and 5 feet high, and the earth ſupported by wooden frames or props.

The gallery being carried on to the place where the powder is to be lodged, the miners make the chamber, which is generally of a cubical form, large enough to hold the wooden box, which contains the powder neceſſary for the charge: the box is lined with ſtraw and ſand-bags, to prevent the powder from contracting dampneſs.

The chamber is ſunk ſomething lower than the gallery, if the ſoil permits; but where water is to be apprehended, it muſt be made higher than the gallery; otherwiſe the beſieged will let in the water, and ſpoil the mine.

Quantities of powder to charge Mines. Before any calculation can be made of the proper charge for a mine, the denſity and tenacity of the ſoil it is to be made in muſt be aſcertained, either by experiment, or otherwiſe; for, in ſoils of the ſame denſity, that which has the greateſt tenacity, will require the greateſt force to ſeparate its parts. The denſity is determined by weighing a cubic foot (or any certain quantity) of the ſoil; but the tenacity can only be determined by making a mine. The following table contains experiments in 6 different ſoils, which may be of ſome aſſiſtance to form a judgement of the nature of the ſoil, when an actual experiment cannot be had.

Nature of the ſoil	Denſity	Tenacity
	Weight of 1 cubic foot	Quant. of powder to raiſe 1 cubicfathom
1. Looſe earth or ſand	95 pds.	8 pds.
2. Common light ſoil	124	10
3. Loam, or ſtrong ſoil	127	11½
4. Potter's clay, or ſtiff ſoil	135	13½
5. Clay, mixed with ſtones	160	16
6. Maſonry	205	21½

All the requiſites in mining may be determined by the following problems, which admit of 4 caſes; for any 3 of the articles below being given, the 4th may thence be found.

1. } The { nature of the ſoil;
2. diameter of the excavation;
3. line of leaſt reſiſtance;
4. charge.

Problem I.

Given the nature of the ſoil, the diameter of the excavation, and the line of leaſt reſiſtance, to find the charge.

Rules.

1. To the ſquare of the diameter of the excavation, add the ſquare of double the line of leaſt reſiſtance, and reſerve the ſaid ſum.

2. Multiply the ſquare root of the reſerved ſum by double the line of leaſt reſiſtance, and ſubtract the product from the ſame ſum.

3. Multiply half the remainder by the line of leaſt reſiſtance, and 1.57 times the product, will give the ſolidity of the excavation.

4. The charge will then be determined from the nature of the ſoil, as in the following example.

Example I.

It is required to make a mine in the ſecond ſort of ſoil, mentioned in the foregoing experiments, which ſhall have a line of leaſt reſiſtance of 10 feet, and the diameter of its excavation 20 feet: what will be the proper charge?

The nature of this ſoil, by the table, requires 10 pounds of powder to 216 cubic feet.

Calculation.

1. The diameter of the excavation is 20, and its ſquare - - -	400
Double the line of leaſt reſiſtance is 20, and its ſquare - - - -	400
Therefore the ſum to be reſerved is -	800
2. The ſquare root of 800 is 28.3 Double the line of leaſt reſiſtance is 20 }	566
Which leaves the remainder	234
3. Half the remainder is - - -	117
Which, multiplied by the line of leaſt reſiſtance, - - - - -	10
Gives the product - - - -	1170
Which multiplied by - - -	1.57
Gives the ſolidity of the excavation - - -	feet 1836.9

4. If

feet. lb. feet. lb.
4. If 216 : 10 :: 1836.9 : 85, which is the charge required.

By Logarithms.

1. Diam. of excav. is = 20	1.301030	
Diameter ſquared is	2.602060	400
Double the line of leaſt reſiſtance is = 20 and its ſquare		400
The ſum to be reſerved is	2.903090	800
2. Square root of ſum is 28.3	1.451545	
Double the line of leaſt reſiſtance is = 20	1.301030	
Product to be ſubtracted is	2.752575	566
Remainder is - -	2.369216	234
Line of leaſt reſiſt. = 10	1.000000	
10 pounds of powder	1.000000	
To 216 cubic feet, *compl. arith.*	7.665546	
To which add the *conſtant log.*	9.894870	
And the ſum is the logarithm charge required - -	1.929632 = 85lb.	

PROBLEM II.

Given the nature of the ſoil, the line of leaſt reſiſtance, and the charge, to find the diameter of the excavation.

RULES.

1. Find the ſolidity of the earth to be raiſed, by a proportion from the nature of the ſoil, and multiply it by 1.27. Divide the product by the line of leaſt reſiſtance, and to the quotient add the ſquare of the line of leaſt reſiſtance: reſerve the ſum.

2. Multiply the ſquare root of the ſum reſerved by twice the line of leaſt reſiſtance, and add the product to the ſaid ſum, and from the reſult ſubtract 3 times the ſquare of the line of leaſt reſiſtance; ſo will the ſquare root of the remainder be the diameter of the required excavation.

EXAMPLE I.

Let a mine be charged with 100 pounds of powder, in a ſoil which requires 11 pounds of powder to raiſe 216 cubic feet, and let its line of leaſt reſiſtance be 10 feet: what will be the diameter of the excavation?

By the nature of the ſoil 11lb. : 216 feet :: 100lb. : 1964 feet, which is the ſolidity of the earth to be raiſed.

1. Therefore multiply - -	1964
By - - - - - -	1.27
The product is - - -	2494.28
Which divided by the line of leaſt reſiſtance, 10, is - -	249.428
To which add the ſquare of the line of leaſt reſiſtance - -	100.000
And the ſum to be reſerved is -	349.428
2. The ſquare root of 349.428 is 18.7, which, multiplied by twice the line of leaſt reſiſtance, 20, gives	374.
This added to the ſum reſerved gives	723.428
From which ſubtract 3 times the ſquare of leaſt reſiſtance -	300.
And there will remain - -	423.428

The ſquare root of which is, 20.5 feet, being the required diameter of the excavation.

By Logarithms.

	Numb.	Logar.	Numb.
Cubic feet =	216	2.334454	
Powder 11lb. *co. ar.*		8.958607	
Charge =	100	2.000000	
Line of leaſt reſiſt. 10 *co. ar.*		9.000000	
Conſtant logarithm		0.103804	
		2.396865	249.4
To which add the ſquare of line of leaſt reſiſtance			100.0
Sum to be reſerved is		2.543323	349.4
Half of which logar. is		1.271661	
Twice line of leaſt reſiſt. 20,		1.301030	
Product to be added is		2.572691	373.8
The reſult is - - - -			723.2
From which ſubtract thrice the ſquare of the line of leaſt reſiſtance			300.0
And there remains		2.626546	423.2
Half of which logar. is		1.313273	20.57

feet, the diameter of the excavation required.

Demonſtration by Algebra.

Let the diameter of excavation (*fig.* 6.) $AB = d$;

$= d$; the line of leaſt reſiſtance $FC = l$; the parameter $= p$, and $n = 1.57$; alſo the ſolid $AEGB = s$. Then will $DC = l + \frac{p}{4}$, and $p \times \overline{l + \frac{p}{4}} = \frac{d^2}{4}$, by the nature of the parobola; therefore $d = \sqrt{p \times \overline{4l + p}}$.

Alſo $n \times \overline{l + \frac{p}{4}} \times \frac{d^2}{4} =$ the ſolid $ADB = \overline{np \times l + \frac{p}{4}}\Big|^2$, and $\frac{np^3}{16} =$ the ſolid EDG; and the difference of theſe gives the ſolid $AEGB = np \times \overline{l + \frac{p}{4}}\Big|^2 - \frac{np^3}{16} = s = np \times \overline{l^2 + \frac{pl}{2}}$; from whence $p = \sqrt{l^2 + \frac{2s}{nl}} - l$, and $4l + p = 3l + \sqrt{l^2 + \frac{2s}{nl}}$, but $d = \sqrt{p \times \overline{4l + p}} = \overline{\sqrt{l^2 + \frac{2s}{nl}} - l^2 \times \frac{2s}{nl} + \sqrt{l^2} - 3l^2}\Big|^{\frac{1}{2}} = 2l$ $\overline{\sqrt{\frac{2s}{nl}} + l^2 + \frac{2s}{nl} + l^2 - 3l^2}\Big|^{\frac{1}{2}}$, which is the rule to problem II. by putting 1.27 for its equal $\frac{2}{n}$.

Again, $s = npl \times \overline{l + \frac{p}{2}}$, as above; and $d^2 = 4pl + p^2$, from whence $p = \sqrt{4l^2 + d^2} - 2l$, which ſubſtituted for its value above, gives $s = nl \times \overline{\sqrt{4l^2 + d^2} - 2l} \times \overline{l + \frac{\sqrt{4l^2 + d^2} - 2l}{2}} = \frac{nl}{2} \times \overline{4l^2 + d^2 - 2 - 2l\sqrt{4l^2 + d^2}}$, which is the rule to problem I.

Loading and ſtopping of Mines. The gallery and chamber being ready to be loaded, a ſtrong box of wood is made of the ſize and figure of the chamber, being about 1-3d or 1-4th bigger than is required for containing the neceſſary quantity of powder: againſt the ſides and bottom of the box is put ſome ſtraw; and this ſtraw is covered over with empty ſand-bags, to prevent the powder from contracting any dampneſs: a hole is made in the ſide next the gallery, near the bottom of the ſauciſſon to paſs through, which is fixed to the middle of the bottom, by means of a wooden peg, to prevent its looſening from the powder; or that, if the enemy ſhould get to the entrance, they may not be able to tear it out. This done, the powder is brought in ſand-bags, and thrown looſe in the box, and covered alſo with ſtraw and ſand-bags; upon this is put the cover of the box, preſſed down very tight with ſtrong props; and, to render them more ſecure, planks are alſo put above them, againſt the earth, and wedged in as faſt as poſſible.

This done, the vacant ſpaces between the props are filled up with ſtones and dung, and rammed in the ſtrongeſt manner: the leaſt neglect in this work will conſiderably alter the effect of the mine.

Then the auget is laid from the chamber to the entrance of the gallery, with ſome ſtraw at the bottom; and the ſauciſſon laid in it, with ſtraw over it: laſtly, it muſt be ſhut with a wooden cover nailed upon it. Great care muſt be taken, in ſtopping up the gallery, not to preſs too hard upon the auget, for fear of ſpoiling the ſauciſſon, which may hinder the powder from taking fire, and ſo prevent the mine from ſpringing. The gallery is ſtopped up with ſtones, earth and dung, well rammed, 6 or 7 feet further from the chamber than the length of the line of leaſt reſiſtance.

Table for the charge of Mines, *according to* Valliere.

Length of the line of leaſt reſiſtance	Charge of powder		Length of the line of leaſt reſiſtance	Charge of powder		Length of the line of leaſt reſiſtance	Charge of powder		Length of the line of leaſt reſiſtance	Charge of powder	
feet	lb.	oz.	feet	lb.	oz.	feet	lb.	oz.	feet	lb.	oz.
1	0	2	12	162	0	23	1140	10	34	3680	12
2	0	12	13	205	15	24	1296	0	35	4019	8
3	2	8	14	257	4	25	1558	9	36	4374	0
4	6	8	15	316	4	26	1647	12	37	4748	11
5	11	11	16	384	0	27	1815	4	38	5144	4
6	20	4	17	460	9	28	2058	0	39	5561	2
7	32	2	18	516	12	29	2286	7	40	6000	0
8	48	0	19	643	0	30	2530	4	41	6439	3
9	68	5	20	750	0	31	2792	4	42	6878	1
10	93	12	21	868	3	32	3072	0	43	7317	4
11	124	12	22	998	4	33	3369	1	44	7756	0

By this conſtruction the radii of the baſes being always equal to the lines of leaſt reſiſtance, the ſolids are ſimilar, and therefore are to each other as the cubes of their axes; i. e. as the cubes of the lines of leaſt reſiſtance: ſo that, taking any one of the charges to be true, the others will be found, by ſaying, *As the cube of the axis, whoſe charge is given, is to its charge, ſo is the cube of the axis of any other mine to its charge.*

For example, let the charge 93¾ of the mine, whoſe line of leaſt reſiſtance is 10 feet, be given, and it be required to find the charge of any other mine, whoſe line of leaſt reſiſtance is given, ſuppoſe 15; then ſay, as the cube 1000 of 10, is to the cube 3375 of 15, ſo is the charge 93¾ to the charge required, which is 316.4, or 316lb. 6 ounces, which is 2 ounces more than in the table. In the ſame manner is found the charge of a mine whoſe line of leaſt reſiſtance is 20; or becauſe 20 is double of 10, the cube of 20 will be double the cube of 10; and therefore 8 × 93¾, or 750lb. will be the charge for that mine.

Table for the charge of MINES, *according to Mr. Muller.*

Diam.	Charge	Diam.	Charge	Diam.	Charge
feet	lb.	feet	lb.	feet	lb.
22	150	42	639	62	1518
24	181	44	711	64	1621
26	2·7	46	773	66	1741
28	255	48	857	68	1842
30	297	50	946	70	1980
32	344	52	1000	72	2098
34	394	54	1115	74	2243
36	452	56	1205	76	2372
38	502	58	1299	78	2501
40	560	60	1406	80	2648

In this table the line of leaſt reſiſtance is ſuppoſed to be always 10 feet, and the charges producing the openings at the ſides of them from 22 feet to 80. Hence, we ſuppoſe that the charge of 93¾ feet of a mine, whoſe line of leaſt reſiſtance and radius of the baſe are each 10 feet, are given; and from thence the reſt are computed by means of theſe equations $KC = \sqrt{AC^2 + FC^2}$ and $p \times KC = a$ (fig. 6.): and, as we have obſerved, by comparing the diameters of the baſes, found, by means of theſe equations, to be rather leſs than thoſe found by experiments, it is preſumed that the diameters, marked in this table, will not be found leſs, but rather greater, in practice.

TABLE *of* CUBE BOXES *for the charges of* MINES, *from 50 to 640 pounds.*

Cha.	Side	Cha.	Side	Cha.	Side	Cha.	Side
50	12.5	155	18.3	255	21.5	450	26.1
55	12.9	160	18.5	260	21.7	460	26.2
60	13.3	165	18.6	270	22.0	470	26.4
65	13.6	170	18.8	280	22.2	480	26.6
70	14.0	175	19.0	290	22.5	490	26.8
75	14.3	180	19.2	300	22.8	500	27.0
80	14.6	185	19.4	310	23.0	510	27.2
85	14.9	190	19.6	320	23.3	520	27.3
90	15.2	195	19.7	330	23.5	530	27.5
95	15.5	200	19.9	340	23.7	540	27.7
100	15.8	205	20.0	350	24.0	550	27.9
105	16.0	210	20.2	360	24.2	560	28.0
110	16.3	215	20.4	370	24.4	570	28.2
120	16.8	220	20.5	380	24.6	580	28.4
125	17.0	225	20.7	390	24.8	590	28.5
130	17.2	230	20.8	400	25.0	600	28.7
135	17.4	235	21.0	410	25.3	610	28.8
140	17.6	240	21.1	420	25.5	620	29.0
145	17.8	245	21.3	430	25.7	630	29.1
150	18.0	250	21.4	440	25.9	640	29.3

A cubic foot of common powder weighs about 55lb. If we ſay, As 55 is to unity, ſo is any other quantity to its cube; that is, if the given quantity of powder be divided by 55; the quotient will be the cube required, and its cube root will be the length of the ſide of the cube box.

Example, to find a cube which ſhall hold 360lb. Divide 360 by 55; you will have 6.545 for the cube expreſſed in feet; and the cube root 1.875 feet, or 22.5 inches of that number, will be the length of the ſide of that cube.

The box muſt always be made ¼ bigger than it ſhould be, on account of the ſtraw and ſand-bags put in it, to keep the powder from receiving any damage from wet; ſo that, if the quantity of powder be 360lb. the ¼ part of it, which is 90, muſt be added, and the ſum 450 divided by 55, to have 8.1818, whoſe ſquare root, 2.86 feet, or 35 inches, will be the ſide required.

Globe of compreſſion in MINES, *from Belidor.* If you imagine a large globe of earth homogeneous in all its parts, and a certain quantity of powder lodged in its centre, ſo as to produce a proper effect without burſting the globe; by ſetting fire to the powder, it is evident, that the exploſion will act all round, to overcome the obſtacles which oppoſe its motion; and as the particles of the earth are porous, they will compreſs each other in proportion as the flame increaſes, and the capacity of the chamber increaſes likewiſe: but the particles of earth next to the chamber will communicate a part of their motion to thoſe next to them, and thoſe to their neighbours; and this communication will thus continue in a decreaſing proportion, 'till the whole force of exploſion is entirely ſpent; and the particles of earth beyond this term, will remain in the ſame ſtate as they were at firſt. The particles of earth that have been acted upon by the force of exploſion will compoſe a globe, which Mr. Belidor calls the *globe of compreſſion.*

From ſeveral experiments with various charges, made by Mr. Belidor at la Fere, and by M. Dalencourt in Portugal, (at the latter of which I was preſent) it appeared, that the greateſt diameter of an excavation may not only be made double, but triple or quadruple; contrary to the general opinion. From theſe experiments we are convinced, that the diameter of the excavation could be made greater than was imagined; but for what reaſon, was not hitherto known, 'till M. Belidor demonſtrated it, in the Memoirs of the Academy of Sciences at Paris, in the year 1762.

To explain the reaſons on which the principles of mines are grounded, it is neceſſary to conſider, not only the reſiſtance which the weight of the earth and the coheſion of the parts make againſt the force of exploſion, but likewiſe the preſſion of the atmoſphere, which is ſo great as to counterbalance a column of water of the ſame baſe, whoſe altitude is 33 feet, which anſwers nearly to a height of a middling ſoil of about 22 feet: ſo that, if the line of leaſt reſiſtance of a mine be 10 feet, the force of exploſion muſt not only overcome the weight of 10 feet of earth above it, but 32 feet, properly ſpeaking. It is, however, to be obſerved, that this weight reſiſts the force of exploſion no longer than 'till the mine burſts, and the exploſion gets a communication with the air; becauſe then the preſſure of the air ceaſes.

Pl. VII. *fig.* 5. As the powder does not fire all at once, but gradually, ſo the force of exploſion increaſes proportionally, and condenſes the earth all round in a ſpheric form, 'till this force overcomes the reſiſtance of the earth and atmoſphere, which cannot happen before the earth riſes in the middle in a ſpheric form, and the radius CA of exploſion extends to the ſurface AB of the earth; and then the exploſion, getting a free communication with the air, raiſes the earth to a conſiderable height, and forms an excavation of a curve-lined figure, ſuch as AEB. The point C repreſents the centre of the powder or chamber.

It is a known principle, eſtabliſhed by facts, that the force of exploſion is always proportional to the quantity of powder fired; and as the force of exploſion acts in a ſpheric form, and ſpheres are as the cubes of their radii, it is evident, that the forces of exploſion, or the quantities of powder fired, are proportional to the cubes of their radii.

This proportion will always hold good in an uniform ſoil, but varies according to the denſity: and if the chamber of a mine be placed in a rock, or ſome other hard ſubſtance, the diameter of the excavation will be greater than it would have been otherwiſe; becauſe the force of exploſion, being reſiſted downwards, will act with more violence towards the ſides, and upwards. A mine, placed in a ſoil of a greater denſity and tenacity than another of the ſame depth, requires a greater charge in proportion; but it muſt be obſerved, that the tenacity is not proportional to the ſurface of the excavation, as M. de Valliere and ſome others pretend, but to the ſolid itſelf, as explained in M. Muller's treatiſe on mines.

To find a proper charge for a mine in any ſoil, ſo as to produce a given diameter, an experiment mine muſt be made in the ſame ſoil, ſufficiently charged, ſo as to produce a proper effect, and the line of leaſt reſiſtance exactly meaſured, as well as the diameter of the opening, by which the radius *C A* of the globe of compreſſion will be found: then ſay, *The cube of the radius of the globe of compreſſion found by the experiment, is to the cube of the radius of the propoſed mine, as the charge of the experiment mine is to the charge required.*

And to find the diameter of the mine whoſe charge is given, ſay, *The charge of the experiment mine, is to the given charge, as the cube of the radius of the firſt, is to the cube of the radius of the ſecond.* From whence the diameter required is found by this equation, $CA^2 - CD^2 = AD^2$.

We have hitherto computed the diameters of mines from their charges; we ſhall now give ſome examples how to find the charges from the given diameters. Thus, a mine, made in the ſame ſoil above mentioned, whoſe line of leaſt reſiſtance is 10 feet, it is required to find the charge ſo as to make a diameter of 40 feet: the ſum of the ſquares of the line of leaſt reſiſtance 10, and ½ the diameter 20, gives 500 for the ſquare of the radius of the globe of compreſſion; and the ſquare root 22.36 of 500, multiplied by 500, gives 11180, for the globe of compreſſion: then the globe of compreſſion 4412 of the ſecond mine, is to the globe of compreſſion 11180, as the charge 160 of the experiment mine, is to the charge required, which will be 405lb. nearly. Again, let a mine, whoſe line of leaſt reſiſtance is 10 feet, be loaded with 170lb. of powder, having a diameter of 20 feet: it is propoſed to make another in the ſame ſoil, whoſe line of leaſt reſiſtance is 15 feet, and diameter 70. To find its charge, ſay, the ſquare 1225 of ½ the diameter 70, added to the ſquare 225 of the line of leaſt reſiſtance 10, gives 1450, whoſe root is 38 nearly; and 1450, multiplied by 38, gives 55100 for the globe of compreſſion; and as the globe of compreſſion of the experiment mine, has been found above to be 2828, we have 2828 : 55100 :: 170 : 3312 lb. of powder for the charge required.

We will now ſhow the application of the globe of compreſſion in the defence of places, and profiles of countermines made at la Fere, and alſo at the famous ſiege of Schweidnitz in 1762. Pl. VII. *fig.* 7, 8, 9. The firſt chamber *C* blew up two 24-pounders towards the trenches: the battery being re-eſtabliſhed, the chamber *D* threw the guns into the ditch: the batteries being re-eſtabliſhed again, the chamber *E* threw the artillery again into the ditch, to the great ſurpriſe of the ſpectators, ſome of whom expected quite the contrary.

In 1764, a battery was raiſed in all its forms at Potſdam, by major Le Fevre, engineer in the Pruſſian ſervice, for two 24-pounders: under the middle of which a gallery, *fig.* 10. 11. was made from the foot *T* of the banquet, of 20 feet long; from which two branches, *G H; G I*, were made, each of 8 feet long, to place the chambers *A, A,* whoſe line of leaſt reſiſtance was 7 feet only, and exactly under the axle-trees of the guns: the gallery was continued in a ſlope, to form 2 other branches, *K L, N K*, in the ſame manner as the preceding ones, but lower, to place the chambers *B, B,* whoſe line of leaſt reſiſtance was 10 feet, and at the ſame diſtance from the former *A*, taken horizontally, in order to have the right-angled iſoſceles triangle *B D C*, *fig.* 10, whoſe hypothenuſe, *B C*, ſhows the direction of the action of the powder.

The intent of little chambers, *A A*, being to overcome the tenacity of the ſoil, without any other effect, were charged each with 20lb. of powder only; whereas the others, *B B*, were each loaded with 600 lb. The length of the leaders was ſo contrived, as to ſet fire to *F*, then to *G*, and from thence to the chambers *A A*, and to the point *K*, at the ſame time; alſo to the chambers *B B*, in a few ſeconds afterwards. The firſt, *A A*, having produced a proper effect, the ſecond, *B B*, met with leſs reſiſtance towards the wheels of the carriages than towards the trail, raiſed the pieces about 240 feet, and then threw them 210 feet from the battery into the ditch.

Though the centres of the two chambers were 18 feet from each other, yet they produced but one excavation, of an elliptic form, whoſe greateſt diameter was 45 feet, and the leaſt 27, the depth 18, the bottom well cleared, [illegible]thout hurting the parapet of the covert-way. If then two mines produced ſo great an excavation, to what extremity will the beſiegers be reduced, if a battery of 10 or 12 pieces of artillery was blown up? for where will they find earth to fill up an excavation of 210 or 240 feet in length, and from 15 to 18 feet deep? What time will be loſt in repairing all theſe damages! and what deſtruction muſt there be amongſt the ſoldiers, from the fire of ſhells, carcaſſes, and grenades, continually thrown into ſuch a confined place!

In 1753, the French king gave orders for ſome experiments to be made at Biſy, to render uſeleſs

leſs the countermines of a beſieged town, by burſting the galleries all round, above and below, to a certain diſtance; or to change theſe galleries into ſo many trenches, by which the covert-way may be taken at once, with very little trouble. The work begun with what belongs to the globe of compreſſion. A ſoil had been fixed upon, the moſt uniform that could be found, which happened to be a hard ſand, mixed with gravel. Four galleries were made, *A, B, C, D* (Pl. XIII. *fig.* 7.) 3 feet wide, and 6 feet high, ſo as to form a rectangle, whoſe ſides anſwered nearly to the four cardinal points: the two oppoſite ones, *A, B,* which faced the north and ſouth, were each 60 feet long, and the other two, *C, D,* which faced the eaſt and weſt, 72 feet: they were lined with ſtones, in order to ſhow that maſonry was rather an advantage, than an obſtacle to the effects of powder. The bottom of theſe galleries had a ſlope of 6 feet 3 inches, and the mean depth was 15 feet under the ſurface of the ground, which terminated in a deſcent from ſouth to north, between the interval of the galleries of that name. In that to the eaſt *C,* a branch, *L K,* was made at right angles, of 24 feet long, and at *K* another, *K F,* at right angles to this, to place a chamber, *E,* 30 feet from the gallery *A,* 36 from *D,* and 42 from *B.* The other galleries were made by means of 2 ſhafts, or pits, *M, I:* the one, *M,* to the ſouth, was 16 feet deep, and the other, *I,* to the north, 20.

When theſe galleries were finiſhed, the laſt ſhaft *I,* was deepened 9 feet more; ſo that the bottom *Y,* (*fig.* 8.) was 29 feet below the ſurface of the ground, near the chamber. After this a gallery *Y X,* was made, going directly under the chamber *E,* with a deſcent of 18 inches, and 5 feet high; by which its top was 14 feet below the centre of the chamber *E*: the whole ſupported with ſtrong oak planks, and ſtill in the ſame ſort of ſoil as mentioned before, but ſo hard, that the miners were obliged to uſe their chiſſels. Such was the diſpoſition belonging to the globe of compreſſion; whoſe object was, to ſee whether it would burſt all theſe galleries. The globe of compreſſion, which had been charged only 24 hours with 3000lb. of powder, was ſet fire to on the 18th of June, 1753, in the preſence of ſeveral officers, and other perſons of quality; when it raiſed the earth about 150 feet high. They then went to ſee whether it had deſtroyed the galleries about it, and to what diſtance the globe of compreſſion had acted. It was found that it formed an excavation perfectly round, of 66 feet diameter, and 17 deep.

The eaſt gallery *C,* lined with maſonry, at 24 feet diſtance from the chamber, was entirely burſt from one end to the other.

The ſouth gallery *A,* at 30 feet diſtance from the chamber, was equally burſt from end to end, excepting 12 feet near the entrance *M,* at the weſt.

The weſt gallery *D,* of 72 feet long, and 36 diſtant from the chamber, was deſtroyed to the length of 42 feet: 18 feet were left near its entrance at the north, and 12 feet at the other end.

The north gallery *B,* which was 60 feet long, and 42 from the chamber, was deſtroyed all but 12 feet at its entrance, at the weſt: ſo there was 48 feet impracticable, which were divided into 2 equal parts by the perpendicular drawn from the centre of the chamber of that gallery. As that line formed a right-angled triangle, with ½ the gallery deſtroyed, whoſe hypothenuſe is 48 feet, which hypothenuſe is the radius of the globe of compreſſion; this ſhows that it would have deſtroyed a gallery at that diſtance, and conſequently quadruple the line of leaſt reſiſtance.

The gallery *Y, X, S,* (*fig.* 8.) which paſſed under the chamber *E,* whoſe top was 14 feet from it, and length 69, could not be entered farther than the length, *Y Z,* of 24 feet, ſo that 45 feet of it was deſtroyed: as the extremity of this gallery was 9 feet beyond the centre of the chamber, it appears, that there remain 60 feet from the middle to the entrance; and as there were 24 feet not deſtroyed, there remained 36 deſtroyed on that ſide, which being taken for the baſe of a right-angled triangle, *Z S E,* and the perpendicular, *E S,* being 14 feet, the hypothenuſe, *E Z,* is found to be 38 feet, which is the radius of the globe of compreſſion: ſo that it would have deſtroyed a gallery whoſe top had been at that diſtance under the mine, conſequently 50 feet under the ſurface of the ground, which is the greateſt diſtance that a gallery can ever be made. From hence it follows, that if the line of leaſt reſiſtance had been 15 or 16 feet, inſtead of 12, the globe of compreſſion would have deſtroyed a gallery of 60 feet diſtant from the chamber; conſequently, if the chamber was placed at that depth, and nearly in the middle between 2 liſtening galleries, whoſe diſtance is generally from 90 to 144 feet, it would have burſted both the envelope, and all thoſe under and above them, by increaſing the quantity of powder in proportion. This proves the great uſe that may be made of the globe of compreſſion in the attack of a place countermined.

Pl. XIII. *fig*. 17. To apply this method of attacking the countermines in a place beſieged, we ſuppoſed the firſt and ſecond parallels made the latter *A*, *B*, *C*, diſtant about 360 feet from the paliſades of the covert-way; and from thence the trenches are carried on in the capital of the ravelin, and in thoſe of the adjacent baſtions of the front attacked; and after this, batteries, *L*, are made of cannons and mortars, to enfilade by ricochet the covert-way and the ramparts parallel to it, to deſtroy their defences. During this time, the ſappers carry on the ſaps towards the places of arms in the covert-way, both ſalient and re-entering; to eſtabliſh the heads *E T*, near the ends of the liſteners, *G*, *G*, before the ſalient angles; and the miners proceed under ground to place chambers *I*, overcharged, between the extremities of the liſteners of the re-entering angles. We ſuppoſe they have taken the precaution to ſink their ſhafts as deep as the countermines; that the chambers may nearly be upon a level with the galleries; and that the ſhafts are placed in the trenches, *K*, which lead from one battery to the other, not to interfere with any other works. From the bottom of theſe ſhafts they make the galleries, *KL*, of about 120 feet long. This will be a work of about 4 or 5 days to the eſtabliſhing their chambers, which ſhould be finiſhed at the ſame time, that they may be ſprung together: by this time the ſappers will be got to the heads *E F*, to induce the beſieged to ſpring ſome of their mines, to deſtroy them.

Suppoſing that they have ſprung 2 or 3 mines at each ſide, as ſoon as this is done, the miners enter into the excavations to diſcover the galleries; which they muſt do at the ſame time, while the ſappers form a lodgment in the excavation. When the galleries are found and cleared, they ſtop up their entrances, to keep in the ſmoke, 'till they want to make uſe of them. On the other hand, all the globes of compreſſion are fired, and from their excavations ſearch is made on the right and left to diſcover the *liſtners*; ſo that, if the meaſures have been rightly taken, 14 entrances into the countermines will be found, by which it will be out of the power of the beſieged to reſiſt equally every where: ſhould there be but half that number practicable, it would be ſufficient to get poſſeſſion of all their mines; of which only thoſe that are convenient to advance the ſiege, are to be changed into trenches.

Fig. 18, and 19, ſhow the diſpoſition of the chambers of countermines, in a profile parallel to the covert-way, and in a profile perpendicular to the ſame.

At the ſiege of Schweidnitz, in 1762, three globes of compreſſion were ſprung; every one of which anſwered beyond expectation.

MINERS, in a *military ſenſe*, are generally ſoldiers: moſt of the foreign regiments of artillery have each a company of miners, commanded by a captain and 2 lieutenants. When the miners are at work in the mines, they wear a kind of hood, to keep the earth that falls, out of their eyes. In the Engliſh ſervice, artillery ſoldiers are commanded for that purpoſe.

MINERS *tools*, conſiſt in ſeveral ſorts of ſpades, wheel-barrows, axes, hand-levers, chiſſels, ſounding-augres, ſledge-hammers, maſons hammers, mattocks, augets, plummets, miners rule, and miners dial, &c.

Different ſorts of MINES, *are as follow:*

Fougaſſes, are a ſort of ſmall mines, frequently made before the weakeſt parts of a fortification, as the ſalient angles and faces, not defended by a croſs fire.

Treffle-MINES, are mines with two chambers only.

T-MINES, ſo called from the great reſemblance of that letter. They are double mines, having four lodgments.

Double T-MINE, has eight lodgments, and four doors.

Triple T-MINE, has twelve lodgments, and ſix doors.

Double Treffle-MINE, has four lodgments, and eight doors.

Triple Treffle-MINE, has ſix lodgments, and twelve doors.

MINION, a piece of ordnance, formerly ſo called, of which were two ſorts, the large and ſmall; anſwering to our preſent 6-pounders. See CANNON.

MINUTE, in *military affairs*, the 60th part of a degree; and, in *computation of time*, the 60th part of an hour: it alſo denotes a ſhort memoir or haſty ſketch taken of any thing in writing.

MOAT, in *fortification*. See DITCH.

MOINEAU, a French term for a little flat baſtion, raiſed upon a re-entering angle, before a curtain which is too long, between two other baſtions. It is commonly joined to the curtain, but ſometimes ſeparated by a foſſe, and then called a detached baſtion. They are not raiſed ſo high as the works of the place.

MOUNT-PAG-NOTE, or *poſt of the invulnerable*, an eminence choſen out of cannon-ſhot of the place beſieged.

MORASS, in *military drawings*, denotes

moor, marſhy, or fenny low grounds, on which waters are lodged.

MORTARS, are a kind of ſhort cannon, of a large bore, with chambers: they are made of braſs or iron. Their uſe is to throw hollow ſhells, filled with powder; which, falling on any building, or into the works of a fortification, burſt, and their fragments deſtroy every thing within reach. Carcaſſes are alſo thrown out of them, which are a ſort of ſhells, with 5 holes, filled with pitch and other combuſtibles, in order to ſet buildings on fire; and ſometimes baſkets full of ſtones, the ſize of a man's fiſt, are thrown out of them upon an enemy, placed in the covert-way in the time of a ſiege. Of late, the very ingenious general Deſaguliers has contrived to throw bags, filled with grape-ſhot, containing, in each bag, from 400 to 600 ſhot of different dimenſions, out of mortars; the effect of which is ſo very awful and tremendous to troops forming the line of battle, paſſing a defile, or landing, &c. pouring down ſhot, not unlike a ſhower of hail, on a circumference of above 300 feet. They are diſtinguiſhed chiefly by the diameter of the bore. For example, a 13-inch mortar is that, the diameter of whoſe bore is 13 inches. There are ſome of 10 and 8-inch diameters; and ſome of a ſmaller ſort, as cohorns of 4.6 inches, and royals of 5.8 inches. See Pl. XIII. *fig.* 5.

All Engliſh mortars are fixed to an angle of 45 degrees, and cuſtom has prevailed to laſh them ſtrongly with ropes to that elevation. In a ſiege, ſhells ſhould never be thrown with an angle of 45 degrees, excepting one caſe only; that is, when the battery is ſo far off that they cannot otherwiſe reach the works: for when ſhells are thrown out of the trenches into the works of a fortification, or from the town into the trenches, they ſhould have as little elevation as poſſible, in order to roll along, and not bury themſelves; whereby the damage they do, and the terror they cauſe to the troops, is much greater than if they ſink into the ground. On the contrary, when ſhells are thrown upon magazines, or any other buildings, with an intention to deſtroy them, the mortars ſhould be elevated as high as poſſible, that the ſhells may acquire a greater force in their fall, and conſequently do more execution. We are the only nation that fix mortars to an elevation of 45 degrees.

The uſe of mortars is thought to be older than that of cannon; for they were employed in the wars of Italy to throw balls of red-hot iron, and ſtones, long before the invention of ſhells. It is generally believed the Germans were the firſt inventors, and that they were actually uſed at the ſiege of Naples, under the reign of Charles VIII. in 1435. Hiſtory informs us, with more certainty, that ſhells were thrown out of mortars at the ſiege of Wachtendonk, in Gelderland, in 1588, by the earl of Mansfield. Shells were firſt invented by an unfortunate accident, by a citizen of Venlo, who, on a feſtival, celebrated in honour of the duke of Cleve, threw a certain number, one of which fell on a houſe, and ſet fire to it; by which misfortune the greateſt part of the city was reduced to aſhes. Mr. Malter, an Engliſh engineer, firſt taught the French the art of throwing ſhells, which they firſt practiſed at the ſiege of Motte, in 1634. The method of throwing red-hot balls out of mortars, was firſt put in practice, with certainty, at the ſiege of Straalſund, in 1675, by the elector of Brandenburg; though ſome ſay in 1653, at the ſiege of Bremen.

Land-MORTARS, are thoſe uſed in ſieges, and of late in battles, mounted on beds; and both mortar and bed are tranſported on block-carriages. There is likewiſe a kind of land-mortars, mounted on travelling-carriages, invented by count Buckeburg, which may be elevated to any degree; whereas ours are fixed to an angle of 45 degrees, and firmly laſhed with ropes.

Partridge-MORTAR, is a common mortar, ſurrounded by 13 other little mortars, bored round its circumference in the body of its metal. The centre one is loaded with a ſhell, and the others with grenades. The vent of the large mortar being fired, communicates its fire to the ſmall ones; ſo that both ſhell and grenades go off at once. The French uſed them in the war of 1701, and more eſpecially at the ſiege of Liſle, in 1708, and at the defence of Bouchain, in 1702.

Hand-MORTARS, frequently uſed before the invention of coehorns. They were fixed at the end of a ſtaff of 4½ feet long, the other end being ſhod with iron to ſtick in the ground: while the bombardier, with one hand, elevates it at pleaſure, he with the other hand fires.

Firelock-MORTARS, *Bombards*, are ſmall mortars, fixed at the end of a firelock: they are loaded as all common firelocks are; and the grenade, placed in the mortar at the end of the barrel, is diſcharged by a flint-lock; and, to prevent the recoil hurting the bombarbier, the bombard reſts on a kind of halberd, made for that purpoſe. They were firſt invented by major-general Siebach, a German, about the year 1740.

Names of the ſeveral parts of a MORTAR.

A. B.	The	whole length of the mortar	Grand diviſions exterior.
A. C.		muzzle	
C. D.		chace	
D. E.		reinforce	
E. F.		breech	
G. H.		trunnions	
a.		vent	Small diviſions exterior.
b.		dolphins	
c. d.		vent aſtragal and fillets	
d. e.		breech ring and ogee	
f. g.		reinforce ring and ogee	
g. h.		reinforce aſtragal and fillets	
i. k.		muzzle aſtragal and fillets	
k. l.		muzzle ring and ogee	
l. m.		muzzle mouldings	
n.		ſhoulders	

o.	The	chamber	Interior parts.
p.		bore	
q.		mouth	
r.		vent	

Chamber in MORTARS, is the place where the powder is lodged: they are of different ſorts, and made variouſly by different nations. The Spaniards uſe chiefly the ſpheric; the French, Germans, and Dutch, the conic, cylindric, and the concave or bottled; the Portugueſe, at preſent, the parabolic; and the Engliſh make them in the form of a fruſtum of a cone. Each nation has its reaſons, good or bad, to prefer their make before that of others: among which, we are of opinion that the concave and cylindric chambers are the beſt.

Dimenſions of braſs land MORTARS, *now in uſe.*

Diameter of the bore	13 inch.	10 inch.	8 inch.	5.8 royal	4.5 cohorn
Total length of the mortar	44.	33.	25.5	16.5	13.5
From the mouth to the reinforce	15.25	10.	8.5	4.75	4.2
Length of the reinforce	8.75	8.1	5.	5.	3.9
Length of the trunnions	7.15	6.3	5.	2.75	2.15
Length of the trunnions from end to end	35.5	26.	20.	12.	9.2
Length of the bore	24.	18.	13.	8.5	7.
Length of the chamber	6.6	4.5	4.	3.	2.7
Greateſt diameter of the chamber	6.6.	4.5	4.	3.	2.7
Leaſt diameter of the chamber	6.	3.6	3.4	2.4	1.4
Diameter of the muzzle ring	21.	15.15	11.2	8.	6.4
Breadth of the muzzle ring	1.1	.8	.6	.7	.5
Breadth of aſtragals and fillets	1.25	1.	.75		
Diſtant from the muzzle ring	1.5	1.	1.		
Diameter near the muzzle aſtragal	18.1	13.2	10.	6.9	5.6
Diameter near the reinforce	18.1	13.2	10.	6.9	5.6
Diameter of the reinforce	21.	15.15	15.1	8.	6.4
Breadth of the ogees	1.5	1.	1.		
Diameter behind the breach aſtragal	18.1	13.2	9.8	6.9	5.9

The dimenſions in the above table are expreſſed in inches.

*Weight of Land-*MORTARS *and ſhells; together with the quantity of powder the chambers hold when full; the weight of the ſhells, and powder for loading them.*

Nature of mortars		13-inch mortar.			10-inch mortar.			8-inch mortar.			5.8-inch royal.			4.5-inch coehorn.		
Mortar's weight	C.	25	0	0	10	2	18	4	0	20	1	0	0	0	3	0
Shell's weight	C.	1	2	25	0	3	2	0	1	17	0	0	13	0	0	7
Shell cont. powder	lb.	9	4	8	4	14	12		3	8	1	1	8	0	8	0
Chamb. cont. powd.	lb.	9	1	8	4	0	0	2	0	10	1	0	10	0	8	0

The dimenſions in this table are expreſſed, where the C. ſtands, in hundreds, quarters, and pounds; and where lb. ſtands, in pounds ounces, and grains.

Land MORTAR-BEDS, are made of ſolid timber, conſiſting generally of 4 pieces, thoſe of the royal and coehorn excepted, which are but one ſingle block. Their uſes are to mount the land-mortars on them, for actual ſervice; and they are well ſecured with iron-work, &c.

Dimenſions of preſent Land MORTAR-BEDS, *in inches.* See Pl. IV. fig. 1. and 2.

Nature of beds		13	10	8	5.8	4.6
Lower bed	length	84.	66.	50.	0.	0.
	breadth	33.	20.	0.	0.	0.
	height	13.	10.	9.	0.	0.
Upper bed	length	83.	65.	49.	31.5	28.5
	breadth	32.5	25.	19.	16.	14.
	height	13.	12.	11.	10.	9.
Breadth quarter round		3.	2.5	2.5	0.	0.
Of the ogee and fillet		4.	3.5	3.	0.	0.
Length of the cavity		20.	16.	12.	8.	5.7
Trun. holes from fore end		31.	20.	15.5	13.3	11.7
Diameter	of trun. holes	7.2	6.4	5.4	3.4	2.4
Depth	of trun. holes	7.	6.	5.	3.2	2.2

Names and number of iron-work, in a 13, 10, *and* 8-*inch* MORTAR-BED.

a. Cap-ſquares	2
b. Eye-bolts	2
c. Joint-bolts	2
d. Under and upper bed-bolts	9
e. Dowel-bars	4
g. Rings with bolts	4
h. Reverſe bars	2
k. End riveting-plates	2
l. Middle plate	1
m. Riveting bolts	6
n. Square riveting bolts	12
p. Traverſing bolts	6
q. Keys, chains, and ſtaples	2

Names and number of iron-work in a royal and coehorn MORTAR-BED.

a.	Cap-ſquares	2
b.	Eye-bolts	2
c.	Joint-bolts	2
d.	Riveting-bolt, with ring	1
f.	Handles, with ſtarts	2
g.	Square riveting-plates	5
h.	Keys, chains, and ſtaples	2

Sea-MORTARS, are thoſe which are fixed in the bomb-veſſels, for bombarding of places by ſea: they are made ſomewhat longer, and much heavier, than the land-mortars.

Dimenſions of Sea-MORTARS, 13 *and* 10 *inches.*

Diameter of the bore divided into	30	30
Length of the bore	75	75
Diameter of the chamber	15	15
Length of the chamber	33	33
From the end of the chamber to the end of the mortar	20	20
Total length of the mortar	128	128
From the muzzle *a* to the reinforce *b*	43	43
Length of the reinforce *b c*	28	28
Thickneſs of the metal at the muzzle, mouldings excepted	8	7
Thickneſs of metal near the reinforce	9	8
Thickneſs of metal at the reinforce	10	9
Thickneſs of metal at the chamber	16	16
Breadth of the muzzle-ring and fillets	4	4
Breadth of the ogee next to it, and of that before the reinforce	3	3
Diſtance from the ogee to the muzzle-aſtragal	6	6
Breadth of the aſtragal and fillets	3	3
Breadth of the ogee behind the reinf.	4	4
The muzzle-ring projects the metal by	1.5	1.5
Diameter of the trunnions	18	18
Length of the trunnions from the mortar	20	20
	d	*d*
The content of the chamber	126	126
Weight of the metal	2.1*d*	1.8*d*

Weight of Sea-MORTARS *and ſhells; with the quantity of powder to fill the ſhells and chambers.*

Diameter of the bore	13-inch mortar			10-inch mortar		
Weight of preſent ſea-mortars - - - C.	81	1	18	32	3	7
Weight of ſhells - C.	1	2	25	0	3	2
Chamb. contains pow. lb.	32	0	0	12	8	c
Shell contains powder lb.	9	4	8	4	14	12

It has been very juſtly obſerved, that the breech of our 13-inch ſea-mortars is loaded with an unneceſſary weight of metal. The chamber thereof contains 32 pounds of powder; and at the ſame time they are never charged with more than 12 or 15 pounds, becauſe the bomb-ketch is unable to bear the violent ſhock of their full charge. Thus the action of the powder is diminiſhed by the vacancy left in the chamber.

Land-MORTAR-BEDS, are made of very ſolid timber, and placed upon very ſtrong timber frames, fixed in the bomb-ketch; to which a pintle is fixed, ſo as the bed may turn round. The fore part of theſe beds is an arc of a circle, deſcribed from the ſame centre as the pintle-hole. The plans, elevations, and ſections, ſhow, in a diſtinct manner, the ſeveral parts of the beds. See Pl. V.

Dimenſions of Sea-MORTAR-BEDS, *of* 13 *and* 10 *inches.*

Length of the bed	94	84
Breadth of the bed	54	47
Height of the bed	27	23
Pintle-hole from the fore-end	39	32
Diameter of the pintle-hole	6.5	[illegible].5
Trunnions from the fore-end	46	4[illegible].5
Diameter of trunnion-holes	13	8
Depth of trunnion-holes	8	5
Diameter of the circular bed	59	59
Height of the circular bed	8	6
Diſtance to the bed-bolſter	15	16
Depth of the cavity	15	12
Its opening above	30	21
Bed-bolſter length	53	44
Length below	29	2.1
Its height	16	17
Its breadth	14	12

Iron-work of Sea-MORTAR-BEDS.

a.	Cap-ſquares	2
b.	Eye bolts	6
c.	Loop bolts	4
d.	Traverſing bolts	4
e.	Middle-plate	1
f.	Riveting-plates	1
g.	Riveting-bolts	6
h.	Croſs-bed bolts	7
l.	Square riveting-plates for ditto	7
k.	Down-bed bolts	15
m.	Bed-bolſter plates	2
	Keys, chains, and ſtaples	6
	Nails to the bed-bolſter bed	4
	Bed-bolſter rings and loops	2

Stone-MORTARS, ſerve to throw ſtones into the enemy's works, when near at hand; ſuch as from the town into the trenches in the covert-way, or upon the glacis; and from theſe trenches into the town. The bore is terminated by two quadrants of a circle, terminated by the reinforce and lines drawn from the ends of the cylinder, made to lodge the tompions parallel to the axis of the mortar. The bottom of the conic chamber is terminated by an arc of 60 degrees, and the round part of the outſide is a ſemi-circle.

Dimenſions of Stone-MORTARS.

		Parts
Diameter of the bore divided into		30
Length of the	bore	37
	chamber	16
Its greateſt diameter		8
Its leaſt diameter		6
Diameter of the cylindric part to hold a wooden tompion		14
Depth or axis of that cylinder		3
From the muzzle to the reinforce		20.5
Length of the reinforce		8
Thickneſs of metal at the	muzzle	3.5
	reinforce	4.5
	chamber-belt	9
	entrance of the chamber	6
The chamber enters into the trunnions by		2
Diameter of the trunnions		40
Length from end to end of the trunnions		40
Breadth of the	muzzle-ring and fillets	3
	chamber-belt	2
	ogee next to the belt	3
Content of the chamber		d 1102
Weight of metal in this mortar		d 3.1

The weight of a 13-inch ſtone mortar is 10 3 4, and the chamber contains 3 pounds of powder.

Chambers in MORTARS, are of different ſorts and dimenſions. Mr. Belidor mentions four; namely, the cylindric, the ſpheric, the conic, and the concave or bottled; to which a fifth may be added, the parabolic, invented by count de Lippe Buckeburg.

Cylindric chambers. This kind of chamber is, in our opinion, for all kind of mortars under a 13-inch diameter, the beſt. They are the only kind of chambers that may be conveniently loaded with cartridges. Though experience demonſtrates that concave chambers will throw the ſhell fartheſt of any with the ſame charge; yet, in this caſe, where but little powder is required, their entrance would become too narrow, and conſequently inconvenient to clean; whereas, when they are cylindric, the difference between the advantages of the one and the other will be but little, and not attended with any inconveniences.

Conic chambers, are generally made in a circular form at the bottom, ſo that the ſides produced, meet the extremities of the diameter at the mouth; it being imagined, I ſuppoſe, that the powder acts in right lines parallel to the ſides of the chamber; but, as that is not the caſe, we conclude, contrary to Belidor and others, that the conic chambers are the worſt of all.

Spheric chambers, are much inferior to the cylindric or concave; for it is well known by the properties of geometry, that when a cylinder and a fruſtum of a cone occupy equal ſpaces, the ſurface of the cone is always greater than that of the cylinder. Hence, if the entrance of theſe chambers be not made very narrow, contrary to practice, as demonſtrated by Mr. Muller, in his ſecond edition of Artillery, page 38 of the introduction, and the examples that follow, we conclude that theſe and the conic chambers are the worſt.

Concave chambers. The advantage of theſe kinds of chambers conſiſts in this, that their entrance may be made narrower than thoſe of any other form; and practice has ſufficiently proved it: yet, when the entrance is ſo ſmall as not to admit a man's hand, they are not eaſily cleaned; for which reaſon all 13 and 10-inch mortars ſhould have concave chambers, and the others cylindric ones.

Parabolic chambers. Theſe chambers, being the wideſt of any, may therefore be included among the worſt; as it is not the inward figure of the chamber, but its entrance, which produces the effect; becauſe the ſmaller it is, the nearer it reduces the effect into the direction of the ſhell. It has however one advantage; namely, that the ſhells will have no windage. See *dimenſions of mortars,* at the word MORTAR. See alſo VENTS.

MORTAR, in *military architecture,* a compoſition of lime, ſand, &c. mixed up with water, that ſerves as a cement to bind the ſtones, &c. of any building. Fine ſand makes weak mortar, and the rounder the ſand, the ſtronger the mortar; and if the ſand is waſhed before it is mixed, ſo much the better.

The proportion of lime and ſand for making of mortar is extremely variable. Some uſe three parts of pit-ſand, and two of river-ſand, to one of lime; others, a proportion of ſand to quick-lime as 36 to 35. It ſhould be well mixed, and beat every 24 hours for a week together, letting it then lie for a week more; and when it is uſed, muſt be beat and mixed again. By this means it will make good mortar, though the lime is but indifferent.

Mortar *for water-courſes, ciſterns,* &c. is made of lime and hog's-lard; ſometimes mixed with the juice of figs, and ſometimes with liquid pitch, which is firſt ſlaked with wine; and, after application, it is waſhed over with linſeed-oil.

Mortar *for furnaces,* &c. is made with red clay wrought in water, wherein horſe-dung and chimney-ſoot have been ſteeped; by which a ſalt is communicated to the water, that binds the clay, and makes it fit to endure the fire. The clay ſhould not be too fat, leſt it ſhould be ſubject to chinks; nor too lean or ſandy, leſt it ſhould not bind enough.

Mortar, made of terras, pozolana, tile-duſt, or cinders, is mixed and prepared in the ſame manner as common mortar; only theſe ingredients are mixed with lime inſtead of ſand in a due proportion, which is to be in equal quantities. As this mortar is to be uſed in aquatic buildings, the lime ſhould be the very beſt.

In fortifications, docks, or piers of harbours, I would lay all the works under water with terras-mortar, and the reſt of the facings, both within and without, with cinder or tile-duſt mortar, for about two feet deep.

MOTION, is defined to be the continued and ſucceſſive change of place. There are three general laws of motion: 1. That a body always perſeveres in its ſtate of reſt, or of uniform motion in a right line, till by ſome external force it be made to change its place: for a body is paſſive in receiving its motion, and the direction of its motion, ſo it retains them without any change, 'till it be acted on by ſomething external. 2. The ſecond general law of motion is, that the change of motion is proportional to the force impreſſed, and is produced in the right line in which that force acts. 3. The third general law of motion is, that action and reaction are equal, with oppoſite directions, and are to be eſtimated always in the ſame right line.

Motion *of an army,* the ſeveral marches and counter-marches it makes, or the changing of its poſt for an advantageous encampment, either with a deſign to beſiege a place, to engage the enemy, or ſhun fighting, &c. See March.

Motion *of a ſhell or ſhot.* See Projectiles.

MOULDS, for caſting ſhot for guns, muſkets, carbines, and piſtols; the firſt are of iron, uſed by the founders, and the others by the artillery in the field, and in garriſon.

Laboratory-Moulds, are made of wood, for filling and driving all ſorts of rockets, and cartridges, &c.

MOULDINGS, *of a gun or mortar,* are all the eminent parts, as ſquares or rounds, which ſerve for ornaments; ſuch as the breech-mouldings. The rings, &c. are alſo called mouldings.

MOUND, in *old military books,* is a term uſed for a bank or rampart, or other defence, partiticularly that of earth.

MOUNT-*guard.* See Guard.

Mounting, in *military affairs,* ſignifies going upon duty: thus mounting a breech, is taking poſſeſſion thereof; mounting guard, mounting the trenches, is going upon duty in thoſe places; but mounting a gun, mortar, or howitzer, is placing them on their carriages or beds.

MOVEMENTS. See Motions *of an army.*

MOVEABLE-*Towers.* See Towers.

MULTANGULAR, is ſaid of a figure, or body, which has many angles.

MUNITION, the proviſions with which a place is furniſhed in order for defence, or which follow a camp for its ſubſiſtence. See Ammunition.

MURAL-*Crown.* See Crown.

MURDRESSES, in *ancient fortification,* a ſort of battlement with interſtices, raiſed on the tops of towers to fire through.

MUSKET, } the moſt uſeful and commo-
MUSQUET, } dious fire-arm uſed by an army. They carry a ball of 29 to 2 pounds. Its length is 3 feet 8 inches from the muzzle to the pan. The Spaniards were the firſt who armed part of their foot with muſkets. At firſt they were made very heavy, and could not be fired without a reſt: they had match-locks, and did execution at a great diſtance. Theſe kinds of muſkets and reſts were uſed in England ſo late as the beginning of the civil wars.

Muskets were firſt uſed at the ſiege of Rhege, in the year 1521.

MUSKETEERS, ſoldiers armed with muſkets; who, on a march, carried only their reſts and ammunition, and had boys to bear their muſkets after them. They were very ſlow in loading, not only by reaſon of the unwieldineſs of the pieces, and becauſe they carried the powder and ball ſeparate, but from the time it took to prepare and adjuſt the match: ſo that their fire was not near ſo briſk as ours is now. Afterwards a lighter kind of match-lock muſket came in uſe; and they carried their ammunition in bandeliers, to which were hung ſeveral little caſes of wood, covered with leather, each containing a charge of powder: the balls they carried looſe in a pouch, and a priming-horn hanging by their ſide. Theſe arms were, about the beginning of this century, univerſally diſuſed in Europe, and the troops were armed with firelocks.

MUSKET-*baſkets*. See BASKETS OF EARTH.

MUSKETOON, a kind of ſhort thick muſket, whoſe bore is the 38th part of its length: it carries 5 ounces of iron, or 7½ of lead, with an equal quantity of powder. This is the ſhorteſt ſort of blunderbuſſes.

MUSTER, in a *military ſenſe*, a review of troops under arms, to ſee if they be complete, and in good order; to take an account of their numbers, the condition they are in, viewing their arms and accoutrements, &c.

MUSTER-*maſter-general*, }
Commiſſary-general of the MUSTERS, } one who takes account of every regiment, their number, horſes, arms, &c. reviews them, ſees the horſes be well mounted, and all the men well armed and accoutred, &c.

MUSTER-*rolls*, liſts of ſoldiers in each company, troop, or regiment, by which they are paid, and the ſtrength of the army is known.

MUTINY, in a *military ſenſe*, to riſe againſt authority. " Any officer or ſoldier who ſhall preſume to uſe traiterous or diſreſpectful words againſt the ſacred perſon of his majeſty, or any of the royal family, is guilty of mutiny.

" Any officer or ſoldier who ſhall behave himſelf with contempt or diſreſpect towards the general or other commander in chief of our forces, or ſhall ſpeak words tending to their hurt or diſhonour, is guilty of mutiny.

" Any officer or ſoldier who ſhall begin, excite, cauſe, or join, in any mutiny or ſedition, in the troop, company, or regiment, to which he belongs, or in any other troop, or company, in our ſervice, or on any party, poſt, detachment, or guard, on any pretence whatſoever, is guilty of mutiny.

" Any officer or ſoldier who, being preſent at any mutiny or ſedition, does not uſe his utmoſt endeavours to ſuppreſs the ſame, or coming to the knowledge of any mutiny, or intended mutiny, does not, without delay, give information to his commanding-officer, is guilty of mutiny.

" Any officer or ſoldier, who ſhall ſtrike his ſuperior officer, or draw, or offer to draw, or ſhall lift up any weapon, or offer any violence againſt him, being in the execution of his office, on any pretence whatſoever, or ſhall diſobey any lawful command of his ſuperior officer, is guilty of mutiny.

MUZZLE *of a gun or mortar*, the extremity at which the powder and ball are put in; and hence the muzzle-ring, muzzle-aſtragal, muzzle-mouldings, &c. See CANNON.

N

NAILS of various ſorts are uſed in artillery. See CARRIAGE.

Garniſh NAILS, in *travelling-carriages*, have pointed heads like diamonds, with a ſmall narrow neck: they ſerve to faſten the plates with roſes, to cover the ſide-pieces from the ends of the trunnion-plates to 5 or 6 inches beyond the centre of the carriage.

Diamond-headed NAILS, ſmall nails, whoſe heads are made like a flat diamond, and ſerve to fix the plates upon travelling-carriages.

Garniſh NAILS, ſmall nails to faſten the plates, both upon the trail and head of travelling-carriages.

Roſe-bud NAILS, are ſmall round-headed nails, drove in the centre of the roſes of the plates.

Counter-ſunk NAILS, thoſe that have flat round heads, ſunk into the iron plates, ſo as to be even with the outſide of it.

Streak-NAILS, are thoſe which faſten the ſtreaks to the fellies of the wheels.

Box-pin NAILS, ſmall nails without heads, to pin the nave-boxes to the naves.

Stub-NAILS, are driven on the outſide of the nave-hoops, to keep them in their places.

Flat-headed NAILS, to faſten the locker or any ſort of hinges.

Dog-NAILS, have flat round heads; and one part of the ſhank next to the head is alſo round.

NAILING *of cannon*. When circumſtances make it neceſſary to abandon cannon, or when the enemy's artillery are ſeized, and it is not however poſſible to take them away; it is proper to nail them up, in order to render them uſeleſs; which is done by driving a large nail or iron ſpike into the vent of a piece of artillery, to render it unſerviceable. There are various contrivances to force the nail out, as alſo ſundry machines invented for that purpoſe, but have never been found of general uſe; ſo that the beſt method is to drill a new vent.

One Gaſper Vimercalus was the firſt who invented the nailing of cannon. He was a native of Bremen, and made uſe of his invention firſt in nailing up the artillery of Sigiſmund Malateſta.

NATIONAL *troops*, are thoſe born in our own dominions, in oppoſition to foreigners.

NAVAL *armament*, the fitting out a fleet, with all kinds of proviſions and military ſtores, for actual ſervice.

Naval *camp*, in *military antiquities*, a fortification, conſiſting of a ditch and parapet on the land ſide, or a wall built in the form of a ſemi-circle, and extended from one point of the ſea to the other. This was ſometimes defended with towers, and beautified with gates, through which they iſſued forth to attack their enemies. Towards the ſea, or within it, they fixed great pales of wood, like thoſe in their artificial harbours: before theſe the veſſels of burthen were placed in ſuch order, as that they might ſerve inſtead of a wall, and give protection to thoſe without; in which manner Nicias is reported by Thucydides to have encamped himſelf. When their fortifications were thought ſtrong enough to defend them from the aſſaults of enemies, it was frequent to drag their ſhips on ſhore, which the Greeks called ενωλκειν, and the Romans *ſubducere*. Around the ſhips the ſoldiers diſpoſed their tents, as appears every where in Homer; but this ſeems only to have been practiſed in winter, when their enemy's fleet was laid up, and could not aſſault them; or in long ſieges, and when they lay in no danger from their enemies by ſea, as in the Trojan war, where the defenders of Troy never once attempted to encounter the Grecians in a ſea-fight.

Naval *crown*, in *Roman antiquity*, a crown conferred, among the Romans, on perſons who, in ſea-engagements, diſtinguiſhed themſelves. A. Gellius ſays, in general, the naval crown was adorned with prows of ſhips. Lipſius diſtinguiſhes two kinds; the firſt he ſuppoſes plain, and given to the common ſoldiers; the other roſtrated, and only given to generals, or admirals, who had gained ſome important victory at ſea.

Naval *officers*, are admirals, captains, lieutenants, maſters, boatſwains, midſhipmen, gunners, &c.

Naval *engagement*, implies, in general, either a ſea-fight between ſingle ſhips, or whole fleets of men of war, or gallies, &c.

NAVE, in *gun-carriages*, that part of a wheel in which the arms of the axle-tree move, and in which the ſpokes are driven and ſupported. See Wheel.

Nave-*hoops*, are flat iron rings to bind the nave: there are generally three on each nave.

Nave-*boxes*, were formerly made of braſs; but experience has ſhown that thoſe of caſt-iron cauſe leſs friction, and are much cheaper: there are two, one at each end, to diminiſh the friction of the axle-tree againſt the nave.

NAVIGATION, the theory and art of conducting a ſhip by ſea, from one port to another, or of diſpoſing and actuating her machinery, by the force of the wind, ſo as to begin and continue her motion at ſea.

NAUMACHIA, in *antiquity*, a ſpectacle among the Romans, repreſenting a ſea-fight, as alſo the place where it was exhibited.

NAUTICAL *planiſphere*, a deſcription of the terreſtrial globe upon a plane, for the uſe of mariners; but more uſually called *chart*.

NAVY, implies, in general, any fleet or aſſembly of ſhips. It is, however, more particularly underſtood of the veſſels of war that belong to a kingdom or ſtate.

Navy-*board*, together with its civil and military departments, conſiſts of a lord high admiral, or lords commiſſioners for executing this office; one firſt lord commiſſioner, and ſix other lord commiſſioners, with a number of inferior officers, and clerks.

Navy, is alſo a collective body of officers employed in his majeſty's ſea-ſervice.

NECESSARIES, in a *military ſenſe*, implies, for each ſoldier, 3 ſhirts, 2 white ſtocks, 1 black hair-ſtock, one pair of braſs claſps for ditto, 3 pair of white yarn ſtockings, 2 pair of linen ſocks, dipped in oil, to be worn on a march; 2 pair of white linen gaiters, if belonging to the guards; 1 pair of black long gaiters, with black leather tops for ditto; 1 pair of half ſpatterdaſhes, 1 pair of linen drawers, 1 pair of red ſkirt breeches, 1 red cap, 1 cockade, 1 knapſack, 1 haverſack, 1 pair of ſhoe-buckles, 1 pair of gaiter-buckles, black leather garters, 2 pair of ſhoes, 1 oil-bottle, 1 bruſh and picker, 1 worm, 1 turn-key, 1 hammer-cap, and 1 ſtopper. See Regimentals.

NEUTRALITY, in *military hiſtory*, a ſtate of indifference, in which a perſon, army, or ſtate, avoids both friendſhip and hoſtility.

NITRE. See Saltpetre.

NON-*commiſſioned officer*. See Officer.

O

OBLIQUE *defence*, that which is under too great an angle, as is generally the defence of the ſecond flank, which can never be ſo good as a defence in front, nor approved of by ſkilful officers. See *Oblique* FIRING, at the word FIRINGS.

OBUS. See HOWITZER.

OCTAGON, in *fortification*, is an eight-ſided figure, or a place that has eight baſtions. See FORTIFICATION.

OFFICERS, in a *military ſenſe*, are of ſeveral denominations and ranks, viz.

Commiſſioned OFFICERS, are thoſe appointed by the king's commiſſion; ſuch are all from the general to the cornet and enſign.

Warrant OFFICERS, thoſe who have no commiſſions, only warrants from ſuch boards, or perſons, who are authoriſed by the king to grant them.

Non-commiſſioned OFFICERS, are ſerjeant-majors, quarter-maſter-ſerjeants, ſerjeants, corporals, drum and fife-majors, who are nominated by their reſpective captains, and appointed by the commanding-officers of regiments, and by them reduced without a court-martial.

General OFFICERS, are thoſe whoſe command is not limited to a ſingle company, troop, or regiment; but extends to a body of forces, compoſed of ſeveral regiments: ſuch are the general, lieutenant-general, major-general, and in ſome armies brigadier-general.

Field OFFICERS, are ſuch as command a whole regiment; as the colonel, lieutenant-colonel, and major.

Staff OFFICERS, are the quarter-maſter-general, and the adjutant-general, who are ſtrictly ſaid only to exiſt in time of war; alſo the quarter-maſters, adjutants, ſurgeons, and chaplains of regiments. See STAFF.

Subaltern OFFICERS, are lieutenants, cornets, and enſigns.

Flag OFFICERS, are admirals who hoiſt flags at the maſt-heads.

Sea OFFICERS, are, in general, all thoſe who have any command in the navy.

OGEE, in pieces of ordnance, an ornamental moulding, in the ſhape of an S, taken from architecture, and uſed in guns, mortars, and howitzers. See CANNON.

OLYMPIAD, in *chronology*, the ſpace of four years, for on the fifth the olympic games were celebrated in honour of Jupiter Olympius, near Olympia. The Greeks began to uſe this epocha a little before the building of Rome.

OLYMPIC *games*, were inſtituted by Hercules, A. M. 2856, in honour of Jupiter Olympius, at Olympia, a city of Elis, in Peloponneſus. They were celebrated every 4 years, about the ſummer ſolſtice. The deſign of them was to accuſtom the young military men to running, leaping, and every other military exerciſe.

OPEN *flank*, in *fortification*, that part of the flank, which is covered by the orillon. See FORTIFICATION.

OPENING *of trenches*, the firſt breaking of ground by the beſiegers, in order to carry on their approaches towards the place.

ORDERS, in a *military ſenſe*, all that is lawfully commanded by ſuperior officers. Orders are given out every day, whether in camp, garriſon, or on a march, by the commanding-officer; which orders are afterwards given to every officer in writing by their reſpective ſerjeants.

ORDER *of battle*. See BATTLE.

ORDERLY *ſerjeant*, } are appointed to at-
ORDERLY *men*, } tend general officers,
or ſuch other officers who are entitled to ſuch, who walk behind them with their arms.

ORDERLY *book*. Every company has ſuch a book for the ſerjeants to write down both general and regimental orders, for the officers to read them.

Military ORDERS, are companies of knights, inſtituted by kings and princes; either for defence of the faith, or to confer marks of honour on their military ſubjects. They are as follow:

Amaranth, an order of military knighthood, inſtituted in Sweden, by queen Chriſtina, in 1645, at the cloſe of an annual feaſt, celebrated in that country, and called *Wirtſchaft*. Their device was the cypher of *Amarante*, compoſed of two *A*'s, the one erect, the other inverted, and interwoven together; the whole incloſed by a laurel crown, with this motto, *Dolce nella memoria*.

Argonauts of St. Nicolas, was the name of a military order, inſtituted by Charles III. king of Naples, in the year 1382, for the advancement of navigation, or, as ſome authors ſay, merely for preſerving amity among the nobles. They wore a collar of ſhells, incloſed in a ſilver creſcent, whence hung a ſhip with this device, *Non credo tempori.*

Order *of Calatrava*, a Spaniſh military order. It was inſtituted in 1130 by Don Santio, of Toledo. The habit of theſe knights is a black garment, with a red croſs upon the breaſt.

Order *of Alcantara*, a Spaniſh military order. It was eſtabliſhed by Ferdinand the ſecond, king of Leon and Caſtile, in 1170. They wore a green croſs upon their garment.

Order *of St. James*, inſtituted by Ferdinand II. in 1175. Theſe knights had the privilege of wearing their hats in the chapter, in the preſence of their ſovereign.

Order *of St. Michael*, inſtituted in 1469, by Lewis XII. in honour of the important ſervices done to France by that archangel at the ſiege of Orleans, where he is ſuppoſed to have appeared at the head of the French troops, diſputing the paſſage of a bridge, and repulſed the attack of the Engliſh, whoſe affairs ever after declined in that kingdom. The order is a rich collar, with the image of that ſaint pendent thereto; with this inſcription: *Immenſi tremor oceani.*

Order *of the Holy Ghoſt*, inſtituted by Henry II. of France, in 1578. The number of knights are 100, beſides the ſovereign, who is always grand maſter.

Order of St. Louis, inſtituted by Louis XIV, in the year 1693. This order has remained entirely in the poſſeſſion of military men, ever ſince its inſtitution, and has been of ſingular uſe in keeping up the ſpirit, and rewarding the ſervices, of thoſe who have diſtinguiſhed themſelves. The number of knights is unlimited, being given to every man of merit. The order is a golden croſs, with eight points, which hang pendent to a broad crimſon ribband. The motto is *Bellicæ virtutis præmium.*

Order *of Mount Carmel*, inſtituted by Henry IV, in 1608.

Order *of St. Lazarus*, is of a very early inſtitution, but has been often neglected, and as often revived, 'till Louis XV. united the order of St. Carmel and St. Lazarus in April 1722. The king is ſovereign, chief, founder, and protector.

Order *of the knights of Malta.* See Malta.

Order *of the knights of the Garter.* See Garter.

Order *of the knights of the Bath.* See Bath.

Order *of the golden fleece*, inſtituted by Philip duke of Burgundy, ſurnamed the Good, in 1429. See Fleece.

Order *of the annunciation*, inſtituted by Amadeo, count of Savoy, ſurnamed the Green, in memory of Amadeo, the firſt earl, who had valorouſly defended the iſland of Rhodes againſt the Turks. The collar belonging to this order is of gold, and on it theſe four letters, *F. E. R. T.* which means *Fortitudo ejus Rhodum tenuit*, with the figure of the Annunciation hanging to it.

Order *of knights templars*, inſtituted at Jeruſalem about the year 1118. At firſt there were but 9 of the order, and the two principal perſons were Hugo de Paganis, and Jeoffroy of St. Omer's. This order, after having performed many great exploits againſt the infidels, became rich and powerful all over Europe; when, on the 22d of May, 1312, the pope, by his bull, pronounced the extinction of the order, and united their eſtates to the order of St. John of Jeruſalem. They took the name of templars, becauſe their firſt habitation ſtood near the temple dedicated to our Saviour at Jeruſalem.

Order *of knights of St. Jago*, inſtituted by king Ramico, of Spain, in commemoration of a victory obtained againſt the Moors, anno 1030. Their enſign is a red croſs in form of a ſword.

Order *of knights of the band*, erected by Alphonſo, king of Spain, in the year 1268. Their name proceeded from the knights wearing a red ſcarf, or lace of ſilk, the breadth of 3 inches, which hung on their left ſhoulder.

Order *of knights of the Redemption*, erected in the kingdom of Arragon, by king James, who conquered the iſland of Majorca, in the year 1212. Their garments are white, with a black croſs thereon.

Order *of Teutonic knights*, eſtabliſhed towards the cloſe of the 12th century, and thus called, as chiefly conſiſting of Germans, anciently called Teutons.

Order *of the knights of St. Stephen*, inſtituted in the year 1561, by Coſmo, duke of Florence. They wear a red croſs with a border of gold.

Order *of merit*, inſtituted by Frederic III, king of Pruſſia, as a reward to thoſe officers whoſe behaviour deſerved ſome marks of diſtinction,

ſtinction. The enſign of this order is a golden ſtar of eight rays, enamelled with blue, which is worn appendant to a black ribbon, edged with ſilver; and the motto is *Pour le mérite.*

Order *of St. Alexander Newſki*, or the red ribbon, which was inſtituted by Peter I. emperor of Ruſſia; but the czarina Catharine I. conferred it in the year 1725.

Order *of the ſtole*, an order of knights inſtituted by the kings of Arragon.

Order *of the golden ſtole*, a Venetian military order, ſo called from a golden ſtole, which thoſe knights wore over their ſhoulder, reaching to the knee, both before and behind, a palm and a half broad. None are raiſed to this order but patricians, or noble Venetians. It is uncertain when this order was inſtituted.

ORDNANCE, a name given to all that concerns artillery: thus, the commander in chief is called maſter-general of the *ordnance*; the lieutenant-general of the *ordnance*, inſtead of *artillery*.

Board of **Ordnance**, is of a very early, but uncertain date; however, in the year 1548, we find Sir Philip Hoby ſtyled maſter of the ordnance; and in 1588, Ambroſe Dudley, earl of Warwick, was maſter of the ordnance. In 1683, the care of the office of ordnance was committed to five principal officers, beſides the maſter-general, then George lord Dartmouth, viz. a lieutenant-general, ſurveyor-general, clerk of the ordnance, ſtore-keeper, and a clerk of deliveries. At preſent the board of ordnance conſiſts of the ſame. This board deliberates, regulates, and orders every thing relating to the artillery and garriſons.

Maſter-general of the **Ordnance**, is an office of the greateſt truſt, honour, and dignity: it is one of the moſt laborious employments in war, and requires the greateſt ability, application, and experience. This officer has the ſole command of the royal regiment of artillery, aſſiſted by a lieutenant-general. By the great power inveſted in the maſter-general by the king, he alone conſtitutes a board. This poſt is of much greater antiquity in France than with us; for hiſtory informs us, that in the year 1358, John de Lion was appointed firſt maſter of artillery. This title continued 'till the year 1397, when John de Soiſi was appointed maſter-general of artillery. This title continued 'till the year 1599, when Maximilian de Bethune, marquis de Roſny, duke de Sully, and marſhal of France, was appointed firſt grand maſter and captain-general of artillery. This title continued 'till the year 1755, when the marquis de Sabrevois was appointed grand maſter of artillery, which title continues to this day.

In 1548, Sir Philip Hoby was ſtyled maſter of the ordnance.

In 1587, we find Ambroſe Dudley, earl of Warwick, ſtyled maſter of the ordnance, and had under him a maſter-gunner and a trench-maſter.

In 1596, the 29th of March, the earl of Eſſex was maſter of the ordnance.

In 1603, the earl of Devon was firſt called general of the ordnance.

In
1609, 27th June, the earl of Totneſs, ditto.
1617, 5th May, lord Vere.
1623, 26th Aug. Sir Richard Morriſon.
1628, Sir Thomas Stafford.
1634, 2d Sept. the earl of Newport.
1660, 22d Jan. Sir William Compton.
1664, 21ſt Oct. Sir Tho. Chicheley, knt. firſt called maſter-general of the ordnance.
1681, 28th Jan. lord Dartmouth.
1689, 28th April, David Schoumberg, eſq;
1693, 28th July, lord viſcount Sidney.
1702, 29th June, earl of Marlborough.
1711, 10th Jan. earl Rivers.
1712, 5th Sept. duke of Hamilton.
1714, 4th Oct. John duke of Marlborough.
1722, 30th June, William earl of Cadogan.
1725, 3d June, John duke of Argyll and Greenwich.
1730, 10th May, John duke of Montagu.
1755, 10th May, Charles duke of Marlborough.
1757, 30th Nov. John lord viſc. Ligonier.
1763, 30th Nov. marquis of Granby.
1772, 30th Nov. George lord viſcount Townſhend.

Honours due to the maſter-general of the **Ordnance**. The ſame reſpect ſhall be paid to him from the troops, as is paid to generals of horſe and foot; that is, on all occaſions, to have the march beat to him; and to be ſaluted by all officers, the colours excepted.

Lieutenant-general of the **Ordnance**, is an officer of great truſt, honour, and dignity; is the next in command under the maſter-general, and always an officer of the greateſt abilities. This office is not of ſuch early date as that of the maſter-general; for in 1597, it was firſt eſtabliſhed, and has continued as follows, viz.

In
1597, Sir George Carew, knight.
1635, Sir William Hayden.
1636, 28th June, Colin Legge, eſq;
1670, 21ſt Nov. David Walter, eſq;
1672, 7th Dec. George Legge, eſq;

In
1681, 28th Jan. Sir Charles Muſgrave.
1687, 1ſt Aug. Sir Thomas Tichbourn.
1688, 26th April, Sir Hugh Goodrick.
1702, 29th June, James Granville, eſq;
1705, 2d May, Thomas Earle, eſq;
1712, 21ſt June, James Hill, eſq;
1714, 20th Sept. Thomas Earle, eſq;
1717, 19th March, Tho. Micklethwaite, eſq;
1718, 22d April, Sir Charles Willis.
1742, 22d April, field-marſhal Wade.
1748, 22d April, Sir John Ligonier.
1757, 30th Nov. lord George Sackville.
1759, 10th Sept. marquis of Granby.
1763, 10th Sept. George lord viſcount Townſhend.
1767, 10th Sept. right hon. Henry Seymour Conway.
1772, 10th Sept. Sir Jeffery Amherſt, knight of the Bath; now lord Amherſt.

Surveyor-general of the ORDNANCE, is the third perſon who conſtitutes that board: it is a civil employment, of great truſt, having the ſuperintendence of the artillery proofs, military buildings, &c.

ORGUES, thick long pieces of wood, pointed and ſhod with iron, clear one of another, hanging perpendicularly each by a rope, over the gate of a ſtrong place, to be dropped in caſe of emergency.

Their diſpoſition is ſuch, that they ſtop the paſſage of the gate, and are preferable to *herſes* or *portculliſes*; becauſe theſe may be either broken by a petard, or ſtopped, by different contrivances, in their falling down. But a petard is uſeleſs againſt an *orgue*; for if it break one or two of the pieces, others immediately fall down and fill up the vacancy.

ORGUES, a number of harquebuſſes linked together, or diverſe muſket-barrels laid in a row, ſo that they may be diſcharged all at once, or ſeparately.

ORTHOGRAPHY. See PROFILE.

ORILLON. See FORTIFICATION.

ORTEIL. See BERM, and FORTIFICATION.

OVERSLAGH, as a *military phraſe*, which is derived from the Dutch, will be better explained by the following table. For inſtance, ſuppoſe 4 battalions, each conſiſting of 8 captains, are doing duty together, and that a captain's guard is daily mounted: if, in the buffs, the ſecond captain is doing duty of deputy-adjutant-general; and the 4th and 7th captains in the king's are acting, one as aid-de-camp, the other as brigade-major; the common duty of theſe three captains muſt be *overſlaghed*, that is, ſlipped over, or equally divided among the other captains.

TABLE *of explanation.*

	N°. of captains	Heads of each column.							
Regiments		1	2	3	4	5	6	7	8
Royal	8	1		8	2	15	19	23	26
Queen's royal	8		6	9	13	16	20	24	27
Old-buffs	8	3		10	14	17	21	25	28
King's own	8	4	7	11		18	22		29
Total	32								

OUT-*poſts*, in a *military ſenſe*, a body of men poſted beyond the grand guard, called out-poſts, as being without the rounds or limits of the camp. See POSTS.

OUT-*works*, in *fortification*, are works of ſeveral kinds, which cover the body of the place, as ravelins, half-moons, tenailles, horn-works, crown-works, counterguards, envelopes, ſwallows-tails, lunettes, covert-ways, glacis, &c.

Theſe out-works, not only cover the place, but likewiſe keep an enemy at a diſtance, and hinder his gaining any advantage of hollow or riſing grounds; as ſuch cavities and eminences may ſerve for lodgements to the beſiegers, facilitate the carrying on approaches, and raiſing their batteries againſt the town. When out-works are placed one before another, you will find a ravelin before the curtain, a horn-work before the ravelin, and a ſmall ravelin before the curtain of the horn-work; then the neareſt to the body of the place muſt be the higheſt, though lower than the body of the place, that they may gradually command thoſe without them, and oblige the enemy to diſlodge, if in poſſeſſion of them.

PACE, in a *military ſenſe*, a meaſure uſed in fortification: it is a meaſure taken from the ſpace between the two feet of a man in walking, uſually reckoned 2½ feet, and in ſome men 3 feet.

Geometrical Pace, is 5 feet; 60,000 of which make one degree of the equator.

PAGEANT, in *ancient military hiſtory*, a triumphal car, chariot, arch, or other like pompous decoration, variouſly adorned with colours, flags, &c. carried about in public ſhows, proceſſions, &c.

PALÆSTRA, in *Grecian antiquity*, a public building, where the youth exerciſed themſelves in the military art, wreſtling, running, playing at quoits, &c.

PAILS, made of wood, with iron hoops and handles, hold generally 4 gallons, and ſerve in the field to fetch water for the uſe of artillery works, &c.

PAILLASSE, in *military hiſtory*, is a French word, adopted and uſed in our language by the military: it implies a canvaſs or ſail-cloth bed-caſe, ſtuffed with ſtraw; litterally, a ſtraw-bed.

PALISADES, in *fortification*, ſtakes made of ſtrong ſplit wood, about 9 feet long, 6 or 7 inches ſquare, 3 feet deep in the ground, in rows about 2½ or 3 inches aſunder, placed in the covert-way, at 3 feet from and parallel to the parapet or ſide of the glacis, to ſecure it from ſurpriſe.

They are alſo uſed to fortify the avenues of open forts, gorges, half-moons, the bottoms of ditches, and, in general, all poſts liable to ſurpriſe. They are uſually fixed perpendicularly, though ſome make an angle inclining towards the ground next the enemy, that the ropes caſt over them, to tear them up, may ſlip off.

Turning Palisades, are an invention of Mr. Coehorn, in order to preſerve the paliſades of the parapet of the covert-way from the beſiegers ſhot. They are ſo ordered, that as many of them as ſtand in the length of a rod, or about 10 feet, turn up and down like traps, ſo as not to be in ſight of the enemy, 'till they juſt bring on their attack; and yet are always ready to do the proper ſervice of paliſades.

PANDOURS, are Hungarian infantry: they wear a looſe garment fixed tight to their bodies by a girdle, with great ſleeves, and large breeches reaching down to their ancles. They uſe fire-arms, and are excellent markſmen: they alſo wear a kind of ſabre, near 4 feet long, which they uſe with great dexterity.

PANNELS, in *artillery*, are the carriages which carry mortars and their beds upon a march.

PARABOLA, in *geometry*, a figure ariſing from the ſection of the cone, when cut by a plane parallel to one of its ſides.

From the ſame points of a cone, therefore, only one parabola can be drawn; all the other ſections within theſe parallels being ellipſes, and all without hyperbolas.

Properties of the Parabola. The ſquare of an ordinate is equal to the rectangle of the abſciſſa, and four times the diſtance of the focus from the vertex.

The perpendicular on the tangent, from the focus, is a mean proportional between the diſtance from the vertex to the focus, and the diſtance of the focus from the point of contact.

All lines within the parabola, which are drawn parallel to the axis, are called diameters.

The parameter of any diameter is a right line, of ſuch a nature that the product under the ſame, and the abſciſſa, is equal to the ſquare of the ſemi-ordinate.

The ſquares of all ordinates to the ſame diameter, are to one another as their abſciſſas.

Carteſian Parabola, is a curve of the ſecond order, expreſſed by the equation $xy = ax^3 + bx^2 + cx + d$, containing 4 infinite legs, being the 66th ſpecies of lines of the third order, according to Sir Iſaac Newton; and is made uſe of by Deſcartes, in the third book of his geometry, for finding the roots of equations of ſix dimenſions by its interſections with a circle.

Diverging Parabola, a name given by Sir Iſaac Newton to 5 different lines of the third order, expreſſed by the equation $yy = ax^3 + bx^2 + cx + d$.

PARADE, in a *military ſenſe*, the place where troops aſſemble, or draw together, to mount guard, or for any other purpoſe.

Parade, in *fencing*, implies the action of parrying, or turning off any thruſt.

PARALLELS, at a ſiege, the trenches or lines made parallel to the defence of the place beſieged: they are alſo called lines of communication, and boyaus.

Parallels, or places of arms, are deep trenches 15 or 18 feet wide, joining the ſeveral attacks together, ſerve to place the guard of the trenches in readineſs to ſupport the workmen when attacked. There are uſually 3 in an attack; the 1ſt, about 300 toiſes from the covert-way; the 2d and 3d, nearer to the glacis.

PARAMETER. See Gunnery, and Projectiles.

PARAPET, in *fortification*, an elevation of earth, deſigned for covering the ſoldiers from the enemy's cannon, or ſmall ſhot: its thickneſs is from 18 to 20 feet; its height 6 on the inſide, and 4 or 5 on that ſide next the country: it is raiſed on the rampart, and has a ſlope called the ſuperior talus, or glacis of the parapets, on which the troops lay their arms to fire over. The ſlope renders it eaſy for the ſoldiers to fire into the ditch. It has a banquette or two on the inſide for the troops who defend it, to mount upon, for better diſcovering the country, the ditch, and counterſcarp, to fire as they find occaſion.

Parapet *of the covert-way*, is what covers that way from the ſight of the enemy; which renders it the moſt dangerous place for the beſiegers, becauſe of the neighbourhood of the faces, flanks, and curtains of the place.

PARK *of artillery*. See Artillery-Park.

Park *of proviſions*, the place where the ſutlers pitch their tents in the rear, and ſell proviſions to the ſoldiers. Likewiſe that place where the bread-waggons are drawn up, and where the troops receive their ammunition-bread, being the ſtore of the army.

PARLEY, in *military matters*, means a conference with an enemy.

To beat a Parley, is to give a ſignal for holding ſuch a conference, by beat of drum, or ſound of trumpet. See Chamade.

PAROLE, in a *military ſenſe*, the promiſe made by a priſoner of war, when he has leave to go any where, of returning at a time appointed, if not exchanged.

Parole, means alſo a word given out every day in orders by the commanding officer, both in camp and garriſon, in order to know friends from enemies.

PARTISAN, in the *art of war*, a perſon dexterous in commanding a party; who, knowing the country well, is employed in getting intelligence, or ſurpriſing the enemy's convoy, &c. The word alſo means an officer ſent out upon a party, with the command of a body of light troops, generally under the appellation of the partiſan's corps. It is alſo neceſſary that this corps ſhould be compoſed of infantry, light-horſe, and huſſars.

PARTY, in a *military ſenſe*, a ſmall number of men, horſe, or foot, ſent upon any kind of duty; as into an enemy's country, to pillage, to take priſoners, and oblige the country to come under contribution. Parties are often ſent out to view the roads and ways, get intelligence, ſeek forage, reconnoitre, or amuſe the enemy upon a march; alſo frequently ſent upon the flanks of an army, or regiment, to diſcover the enemy, if near, and prevent ſurpriſe or ambuſcade.

PARRYING, in *fencing*, the action of warding off the puſh or blow aimed at one by another. See Fencing.

PASS, in a *military ſenſe*, a ſtrait, difficult, and narrow paſſage, which ſhuts up the entrance into a country.

PASS,
PASSADE, } in *fencing*, an advance or leap forward upon the enemy.

Passade, in the *manage*, is a horſe's walking or trotting in ſuch a manner, that he raiſes the outward hind-leg and the inward fore-leg together; and, ſetting theſe two on the ground, raiſes the other two alternately, never gaining above a foot of ground at a time.

Pass-*parole*, in *military affairs*, a command given at the head of an army, and thence communicated to the rear, by paſſing it from mouth to mouth.

Pass-*port*, or Pass, in *military matters*, a licence or writing obtained from a prince or governor, &c. granting liberty and ſafe conduct to paſs through his territories without moleſtation.

Pass-*volant*,
Passe-*volant*, } in a *military ſenſe*, the ſame with faggot. See Faggot.

PATEE, in *fortification*, a ſmall work reſembling a horſe-ſhoe; that is, an elevation of earth, of an irregular form, generally oval, with a parapet. It is frequently raiſed in marſhy grounds, to cover the gate of a place, having only a direct defence, but nothing to flank it.

PATROL, in *war*, rounds made by the different guards, in the night-time, to obſerve what paſſes in the camp, out-poſts, ſtreets, centries, &c. to ſecure the peace and tranquillity of a city or camp; as alſo to keep all on duty alert. The patrol generally conſiſts of 6 or 12 men and a ſerjeant.

They go every hour in the night from the beating of the tattoo until the reveille: they are to walk in the ſtreets in garriſons, and all over the camp in the field, to prevent diſorders, or any number of people from aſſembling together: they are to ſee the lights in the ſoldiers barracks put out, and to take up all the ſoldiers they find out of their quarters.

Sometimes *patrols* conſiſt of an officer and 30 or 40 men, as well infantry as cavalry; but then the enemy is generally near at hand, and conſequently the danger greater.

PAVILION, in *military affairs*. See Tent.

PAY, or *pay of the army*, is the ſtipend or ſalary allowed for each individual ſerving in the army; firſt eſtabliſhed by government in the year 1660, and not altered ſince.

Daily pay of each rank in the horſe and grenadier-guards.	Horſe-guards		Grenadier-guards	
	Full-pay	Subſiſt.	Full-pay	Subſiſt.
Captain and colonel	1 16 0	1 7 0	1 10 0	1 2 6
Lieutenant and lieutenant-colonel { 1ſt	1 11 0	1 3 3	——	——
2d	1 7 0	1 0 6	1 2 6	0 17 0
Cornet and major, H. G. major in G. G	1 6 0	0 19 6	1 0 0	0 15 0
Guidon and major	1 4 0	0 18 0	——	——
Exempt and Capt. H. G. Lieut. and Capt. G. G.	0 16 0	0 12 1	0 17 0	0 13 0
Brigadier and lieut. H. G. ſub-lieut. G. G.	0 11 0	0 8 2	0 10 0	0 7 6
Guidon and captain	——	——	0 16 0	0 12 0
Sub-brigadier and cornet	0 6 0	0 4 0	——	—— 0
Chaplain	0 6 8	0 5 0	0 6 8	0 5
Adjut. and lieut. H. G. ſub-lieut. and adj. G. G.	0 11 0	0 8 0	0 7 0	0 5 6
Surgeon	0 8 0	0 6 0	0 8 0	0 6 0
Quarter-maſter H. G. ſerjeant G. G.	0 6 0	0 4 9	0 4 0	0 3 6
Corporal	0 5 0	0 3 9	0 3 0	0 2 6
Trumpeter and kettle-drum H. G. hautboys or drum G. G.	0 5 0	0 4 0	0 2 6	0 2 0
Private man	0 4 0	0 2 10	0 2 6	0 2 0

Beſides the pay, as above, there are warrant-men allowed on the eſtabliſhment, viz. to a colonel 6, to a lieutenant colonel 3, to a major 2, to a captain, ſub-lieutenant, adjutant, and clerk, 1 each; to agent H. G. 2, to G. G. 3; riding-maſter H. G. 1, to G. G. 2: allowance to the purveyor and rough-rider 1s. each.

N. B. The fractions, as being inconſiderable, are omitted.

Daily pay of each rank in his majeſty's land-forces. Britiſh.	Royal reg. of horſe-guards		Dragoons		Foot-guards		Foot	
	F. pay	Subſiſt.	F. pay	Subſiſt.	F. pay	Subſiſt.	F. pay	Subſiſt.
Colonel	2 1 0	1 11 0	1 15 0	1 6 6	1 19 0	1 10 0	1 4 0	0 18 0
Lieutenant-colonel	1 9 6	1 2 6	1 4 6	0 18 6	1 8 6	1 1 6	0 17 0	0 13 0
Major	1 7 0	1 1 6	1 0 6	0 15 6	1 4 6	0 18 6	0 15 0	0 11 6
Captain	1 1 6	0 16 0	0 15 6	0 11 6	0 16 6	0 12 6	0 10 0	0 7 6
Capt. lieut. or lieut.	0 15 0	0 11 6	0 9 0	0 7 0	0 7 10	0 6 0	0 4 8	0 3 6
Cornet H. G. and drag. Enſ. F. G. E. or 2 L. F.	0 14 0	0 11 0	0 8 0	0 6 0	0 5 10	0 4 6	0 3 8	0 3 0
Chaplain	0 6 8	0 5 0	0 6 8	0 5 0	0 6 8	0 5 0	0 6 8	0 5 0
Adjutant, or ſolicitor	0 5 0	0 4 6	0 5 0	0 4 6	0 4 0	0 3 0	0 4 0	0 3 0
Quarter-maſter	0 8 6	0 6 6	0 5 6	0 4 0	0 4 0	0 3 0	0 4 8	0 3 6
Surgeon	0 6 0	0 4 6	0 6 0	0 4 6	0 4 0	0 3 0	0 4 0	0 3 0
Surgeon's mate	——	——	——	——	0 3 0	0 3 0	0 3 6	0 3 0
Drum-major	——	——	——	——	0 1 0	0 1 0	——	——
Deputy-marſhal	——	——	——	——	0 1 0	0 0 9	——	——
Serjeant	——	——	0 2 9	0 2 3	0 1 10	0 1 4	0 1 6	0 1 0
Corporal	0 3 0	0 2 6	0 2 3	0 1 9	0 1 2	0 0 10	0 1 0	0 0 8
Kettle-drum	0 3 0	0 2 6	——	——	——	——	——	——
Drummer	0 3 0	0 2 6	0 2 3	0 1 9	0 1 2	0 0 8	0 1 0	0 0 8
Trumpeter	0 2 8	0 2 0	——	——	——	——	——	——
Private man	0 2 6	0 2 0	0 1 9	0 1 5	0 0 10	0 0 6$\frac{6}{7}$	0 0 8	0 0 6

Beſides the pay the following allowances are made: To the colonel of the royal regiment of horſe-guards 4s. per day; dragoons 2s. 6d. foot-guards 1s. 7½d. foot 1s. 2d. To the captains of the horſe-guards 4s. dragoons 4s. foot-guards 1s. 1½d. foot 1s. per day.

Daily pay of the roy. reg. of artillery	Full pay		Arrears	
	Pay	Subſiſt.	per day	per ann.
Serjeants	0 2 0	0 1 $7\frac{1}{4}$	0 0 $4\frac{1}{2}$	6 9 $3\frac{1}{4}$
Corporals	0 1 10	0 1 $6\frac{1}{2}$	0 0 $3\frac{1}{2}$	5 6 $5\frac{1}{2}$
Bombardiers	0 1 8	0 1 $4\frac{1}{2}$	0 0 $3\frac{1}{2}$	5 6 $5\frac{1}{2}$
Gunners	0 1 4	0 1 $1\frac{1}{4}$	0 0 $2\frac{3}{4}$	4 3 $7\frac{1}{4}$
Matroſſes	0 1 0	0 0 $9\frac{1}{2}$	0 0 $2\frac{1}{2}$	3 16 $0\frac{1}{2}$
Fifers	0 1 0	0 0 $9\frac{1}{2}$	0 0 $2\frac{1}{2}$	3 16 $0\frac{1}{2}$
Drummers	0 1 0	0 0 $9\frac{1}{2}$	0 0 $2\frac{1}{2}$	3 16 $0\frac{1}{2}$

N. B. The officers are the ſame as the foot in the preceding table.

PAY-*maſter*, is he who is intruſted with the money, and has the charge of paying the company.

PEACE, a ſtate of tranquillity, and generally uſed in oppoſition to war. See WAR.

PEDRERO. See MORTAR.

PENDULUM, in *mechanics*, any heavy body ſo ſuſpended, as that it may vibrate backwards and forwards, about ſome fixed point, by the force of gravity.

A pendulum is any body, as B (Pl. X. *fig*. 6.) ſuſpended upon, and moving about, a point A as a centre. The nature of a pendulum conſiſts in the following particulars. 1. The times of the vibrations of a pendulum, in very ſmall arches, are all equal. 2. The velocity of the bob, in the loweſt point, will be nearly as the length of the cord of the arch which it deſcribes in the deſcent. 3. The times of vibrations in different pendulums, AB, AC, are the ſquare roots of the times of their vibrations. 4. The time of one vibration is to the time of deſcent, through half the length of the pendulum, as the circumference of a circle is to its diameter. 5. Whence the length of a pendulum, vibrating ſeconds in this latitude, will be found to be 39 inches and 2-10ths; and of one half-ſecond pendulum 9.8 inches. 6. An uniform homogeneous body BG (Pl. X. *fig*. 7.) as a rod, ſtaff, &c. which is 1-3d part longer than a pendulum AD, will vibrate in the ſame time with it.

From theſe properties of the pendulum, we may diſcern its uſe as an univerſal chronometer, or regulator of time. By this inſtrument, alſo, we can meaſure the diſtance of a ſhip, of a battery, &c. by meaſuring the interval of time between the fire and report of the gun; alſo the diſtance of a cloud, by counting the ſeconds or half-ſeconds, between the lightning and the thunder. Thus, ſuppoſe between the lightning and thunder we count 10 ſeconds; then, becauſe ſound paſſes through 1142 feet in one ſecond, we get the diſtance of the cloud = 11420 feet. Again, the height of any room, or other object, may be meaſured by a pendulum vibrating from the top thereof. Thus, ſuppoſe a pendulum from the height of a room, or other object, vibrates [illegible] in three ſeconds; then ſay, as 1 is to the [illegible] of 3, viz. 9, ſo is 39.2 to 352.8 feet, the height required. Laſtly, by the pendulum we diſcover the different force of gravity on divers parts of the earth's ſurface, and thence the true figure of the earth.

PENSIONS *for officers widows.* Colonel's widow 50l. lieut. colonel's 40l. major's 30l. captain's 26l. lieutenant's 20l. enſign's 16l. cornet's 16l. adjutant's 16l. quarter-maſter's 16l. ſurgeon's 16l. and chaplain's 16l.

PENSIONERS, or *band of gentlemen penſioners*, raiſed in 1509 by king Henry VIII. to guard his perſon. They conſiſt of a captain, lieutenant, ſtandard-bearer, clerk of the cheque, and 40 gentlemen penſioners, with a ſalary of 100l. a year each. They have alſo a paymaſter, harbinger, ax-keeper, and meſſenger.

PENTAGON, in *fortification*, a figure bounded by 5 ſides, or polygons, which form ſo many angles, capable of being fortified with an equal number of baſtions. It alſo denotes a fort with 5 baſtions.

PERCH, in menſuration, is 10 feet long. See MEASURE.

PERCUSSION, in *phyſics*, the impreſſion a body makes in falling or ſtriking another; or the ſhock of two moving bodies: and it is either direct or oblique.

Direct PERCUSSION, is where the impulſe is given in the direction of a right line perpendicular to the point of contact.

Oblique PERCUSSION, when it is given in the direction of a line oblique to the point of contact.

Centre of PERCUSSION, of a body in motion, is that point in which all the forces of the ſame are conſidered as united together in one; ſo that, if the ſaid body meets any obſtacle contrary to the motion thereof, it ſtrikes the obſtacle with a greater force than any other point of the body; and conſequently, if the percutient body revolves round a fixed point, and in its motion ſtrikes any obſtacle with its centre of percuſſion, it will, during a ſmall particle of time, preſerve an equilibrium about that point.

Let the inflexible right line PB (Pl. XIII. *fig*. 4.) with two given weights A, B, appended at the point A and B, revolve about the fixed point P, as a centre; and let it be required to determine the centre of percuſſion C, of the ſaid weights.

Put $BC = x$; then $CA = BA - x$. The velocity with which B revolves, is as PB; therefore its force may be expreſſed $PB \times B$; and by the ſame way of reaſoning, the force of A may be expounded by $PA \times A$: therefore, by the above definition of the centre of percuſſion, we have $PB \times B \times x = \overline{BA - x} \times PA \times A$; hence $x = \dfrac{PB \times PA \times A}{PB \times B + PA \times A}$; ſubtract this from PB, and we have PC, or the diſtance of the centre of percuſſion from the point of ſuſpenſion P, $= \dfrac{PA^2 \times A + PB^2 \times B}{PA \times A + PB \times B}$ If there were three, or a greater number of weights affixed to the rod PB, the diſtance of their centre of percuſſion from the point of ſuſpenſion would, in like manner, be found by firſt multiplying each weight into the ſquare of its diſtance from the point of ſuſpenſion, and dividing the ſum of theſe products by that of the products ariſing from the multiplication of each weight into its reſpective diſtance, from the point of ſuſpenſion. Hence it appears that the centre of percuſſion is the ſame with the centre of oſcillation.

PERPENDICULAR, in *geometry*, a line falling directly upon another line, ſo as to make equal angles on each ſide.

PERDUE, in *war*, denotes the forlorn hope; and *to lie perdue*, is to lie flat and cloſely in wait.

PERSPECTIVE, is the art of drawing the reſemblances or pictures of objects on a plane ſurface, as the objects themſelves appear to the eye, &c.

PETARD, in *war*, an engine to burſt open the gates of ſmall fortreſſes: it is made of gun-metal, fixed upon a board two inches thick, and about 2½ feet ſquare, to which it is ſcrewed, and holds from 9 to 20 pounds of powder, with a hole at the end oppoſite to the plank to fill it, into which the vent is ſcrewed: the petard thus prepared is hung againſt the gate by means of a hook, or ſupported by three ſtaves faſtened to the plank: when fired, it burſts open the gate. Its invention is aſcribed to the French Huguenots in 1579, who, with them, took Cahors in 1579.

PETARDIER, he who loads, fixes, and fires the petard.

PETITE-GUERRE, is carried on by a light party, commanded by an expert partiſan, and which ſhould be from 1000 to 2000 men, ſeparated from the army, to ſecure the camp or a march; to reconnoitre the enemy or the country; to ſeize their poſts, convoys, and eſcortes; to plant ambuſcades, and to put in practice every ſtratagem for ſurpriſing or diſturbing the enemy; which is called carrying on the *Petite-guerre*. The genius of theſe days, and the operations of the laſt war, have placed the ſervice of ſuch a corps in a moſt reſpectable light, as it is more fatiguing, more dangerous, and more extenſive.

To form a corps capable of carrying on the *Petite-guerre* to advantage, prudence requires that it ſhould conſiſt of 1000 men at leaſt, without which a partiſan cannot expect to ſupport the fatigues of a campaign, and ſeize the moſt important occaſions that every where offer, and which a too great inferiority muſt make him forego.

It is no leſs important that this corps ſhould be compoſed of infantry and cavalry; and as it is inconteſtible that the cavalry ſhould be the moſt active in carrying on the *Petite guerre*, it were to be wiſhed that they were likewiſe the ſtrongeſt, ſo as to have 600 cavalry and 400 infantry in a corps of 1000 men, making 4 companies of infantry, and 12 troops of cavalry. Each company of infantry to conſiſt of 1 captain, 1 firſt and 2 ſecond lieutenants, 4 ſerjeants, and 96 men, including 4 corporals, 4 lance corporals, and 2 drummers. Each troop of cavalry to conſiſt of 1 captain, 1 firſt and 1 ſecond lieutenant, a quarter-maſter, 2 ſerjeants, and 48 horſemen; including 4 corporals, a trumpeter and farrier.

The commanding-officer ſhould have the naming of the officers of this corps, or at leaſt the liberty to reject ſuch as he is convinced are not qualified for ſuch ſervice. To ſupport the honour of this corps upon a ſolid and reſpectable footing, the ſtricteſt ſubordination muſt extend from the chief to all the officers, and the moſt rigid diſcipline inſpire vigilance, patience, bravery, and love of glory in the whole corps.

PHALANX, in *ancient military hiſtory*, a large ſquare battalion of infantry, joined cloſe together, with their ſhields in cloſe order, and pikes turned croſs-ways. The phalanx was a form peculiar to the Macedonians: the front exceeded the depth, and the depth conſiſted generally of 16 men.

PICKETS, in *fortification*, ſtakes ſharp at one end, and ſometimes ſhod with iron, uſed in laying out the ground, of about 3 feet long; but, when uſed for pinning the faſcines of a battery, they are from 3 to 5 feet long.

Pickets, in *artillery*, are about 5 or 6 feet long, ſhod with iron, to pin the park lines, in laying out the boundaries of the park.

Pickets, in the *camp*, are alſo ſtakes of about 6 or 8 inches long, to faſten the tent cords, in pitching the tents; alſo, of about 4 or 5 feet long, driven into the ground near the tents of the horſemen, to tie their horſes to.

Picket, an out-guard poſted before an army, to give notice of an enemy approaching. See Guard.

Picket, a kind of puniſhment ſo called,

where a ſoldier ſtands with one foot upon a ſharp-pointed ſtake: the time of his ſtanding is limited according to the offence.

PIECES, ſignify cannon of all denominations. See CANNON.

Regimental PIECES, are light 3 and 6-pounders: each regiment has generally two of theſe pieces.

Field-PIECES, are light 3, 6, and 12-pounders. See CANNON.

Battering-PIECES, are heavy, 12, 18, and 24-pounders, uſed in ſieges for battering the works of a fortification. See CANNON.

Garriſon-PIECES, are moſtly heavy 6, 9, 12, 18, 24, 36, and 42-pounders, beſides wall-guns.

PIKE, in *war*, an offenſive weapon, conſiſting of a wooden ſhaft, 12 or 14 feet long, with a flat ſteel head, pointed, called the ſpear. This weapon was long in uſe among the infantry; but now the bayonet, which is fixed on the muzzle of the firelock, is ſubſtituted in its ſtead. It is ſtill uſed by ſome of the officers of infantry, under the name of ſponton. The Macedonian phalanx was a battalion of pike-men.

PILES *of ſhot or ſhells*, are generally piled up in the king's magazines, in three different manners: the baſe is either a triangular ſquare, or a rectangle; and from thence the piles are called triangular, ſquare, and oblong.

TABLE *of triangular* PILES *of ſhot.*

Side	Content	Side	Content	Side	Content	Side	Content
2	4	13	473	24	2437	35	7486
3	10	14	574	25	2751	36	8184
4	20	15	696	26	3091	37	9322
5	35	16	731	27	3458	38	10131
6	56	17	883	28	3853	39	10981
7	84	18	1043	29	4277	40	11871
8	120	19	1222	30	4731	41	12807
9	165	20	1540	31	5216	42	13730
10	220	21	1641	32	5733	43	14659
11	296	22	1883	33	6283	44	15585
12	384	23	2148	34	6867	45	16511

Explanation.---The numbers in the 1ſt, 3d, 5th, and 7th vertical columns, expreſs the number of ſhot in the baſe or ſide of each triangular pile; and the numbers in the 2d, 4th, 6th, and 8th vertical columns, expreſs the number of ſhot in each pile.

If the triangular priſm *ABCD* of ſhot (Pl. XIII. *fig.* 3.) whoſe ſide *BD* or *AC*, is equal to the corner row *AB*, be cut diagonally by a plane *CF*, it is evident that the triangular pyramid *CFD*, is 1-3d of the priſm; and the remainder *CFA*, the 2-3ds.

Now becauſe the number of ſhot in the triangular baſe *ABC*, is expreſſed by the terms 1, 2, 3, 4, 5, &c. of the natural numbers, whoſe laſt term $= z$, the number of ſhot in the baſe *AC*; and the ſum of all the terms, to the ſum 1 + 2 of the firſt and laſt multiplied by $\frac{1}{2}z$ half their number; that is, to $\frac{1}{2}z \times \overline{z+1}$.

The baſe *ABC*, multiplied by z, the number of triangles contained in the priſm *ABDC*, gives $\frac{1}{2}\,zz \times \overline{z+1}$ for its content, and $\frac{2}{3}$, $\frac{1}{2}zz \times \overline{z+1}$ of which, that of the part *AFC*. But it is evident, that the plane *CF* cuts the triangular range *CB* into two parts; the one, *CFB*, is for the ſame reaſon as above, $\frac{1}{3}$ of $\frac{1}{2}$ $z \times \overline{z+1}$ that range, which third $\frac{1}{6}z \times \overline{z+1}$, will expreſs the part *CFB*. This being added to $\frac{1}{3}\,zz \times \overline{z+1}$, found before gives $\frac{1}{3}\,zz \times \overline{z+1} + \frac{1}{6}z \times \overline{z+1}$, or $\frac{1}{6}z \times \overline{z+1} \times \overline{zz+1}$, when reduced under the ſame denomination, for the ſquare pile *ABC*, or fig. 2. *ABCD*.

Rule I. Multiply the baſe by the baſe more 1, this product by the baſe more 2, and divide by 6.

Example I. Let the baſe or corner row of a complete triangular pile be 20; then $\frac{20 \times 21 \times 22}{6} = 10 \times 7 \times 22 = 1540$, for the number of ſhot required.

TABLE *of ſquare* PILES *of ſhot.*

ſide	content	ſide	content	ſide	content	ſide.	content	ſide	content
2	5	20	2871	38	19019	56	60116	74	137825
3	14	21	3311	39	20540	57	63365	75	143450
4	30	22	3795	40	22140	58	66729	76	149226
5	55	23	4324	41	23821	59	70210	77	155155
6	91	24	4900	42	25585	60	73810	78	161239
7	140	25	5525	43	27434	61	77531	79	167480
8	204	26	6201	44	29370	62	81375	80	173880
9	285	27	6930	45	31395	63	85344	81	180441
10	385	28	7714	46	33511	64	89440	82	187165
11	506	29	8555	47	35720	65	93665	83	194054
12	650	30	9455	48	30824	66	98021	84	201110
13	819	31	10416	49	40425	67	102510	85	208335
14	1015	32	11140	50	42925	68	107134	86	215731
15	1240	33	12529	51	45526	69	111895	87	223300
16	1496	34	13685	52	48230	70	116795	88	231044
17	1785	35	14910	53	51939	71	121830	89	238965
18	2109	36	16206	54	53953	72	127022	90	247065
19	2470	37	17575	55	56980	73	132349	91	255346

[To be placed oppoſite *Table of oblong*
PILES *of ſhot*, at the word PILES.]

	1	2	28	29	30	31	32	33	34	35	36	37	38
10	385	4	1878	1925	1980	2035	2090	2145	2200	2255	2310	2365	2420
11	506	5	2288	2354	2420	2486	2552	2618	2684	2750	2816	2882	2948
12	650	7	2756	2834	2912	2990	3068	3146	3224	3302	3380	3458	3536
13	819	9	3276	3367	3458	3549	3640	3731	3822	3913	4004	4095	4186
14	1015	11	3850	3955	4060	4165	4270	4375	4480	4585	4690	4795	4900
15	1240	13	4480	4600	4720	4840	4960	5080	5200	5320	5440	5560	5680
16	1496	16	5168	5304	5440	5576	5712	5848	5984	6120	6256	6392	6528
17	1785	19	5916	6069	6222	6375	6528	6681	6834	6987	7140	7293	7446
18	2109	22	6726	6897	7068	7239	7410	7581	7752	7923	8094	8265	8436
19	2470	26	7600	7790	7980	8170	8360	8550	8740	8930	9020	9310	9500
20	2870	30	8540	8750	8960	9170	9380	9590	9800	10010	10220	10430	10640
21	3311	35	9548	9779	10010	10241	10472	10703	10934	11165	11396	11627	11858
22	3795	40	0626	10879	11132	11385	11638	11891	12144	12397	12650	12903	13156
23	4324	46	1776	12052	12328	12604	12880	13156	13432	13708	13984	14260	14536
24	4900	52	3000	13300	13600	13900	14200	14500	14800	15100	15400	15700	16000
25	5525	58	4300	14625	14950	15275	15600	15925	16250	16575	16900	17225	17550
26	6201	65	5678	16029	16380	16731	17082	17433	17784	18135	18486	18837	19188
27	6930	73	7136	17514	17892	18270	18648	19026	19404	19782	20160	20538	20916
28	7714	81	8676	19082	19488	19894	20300	20706	21112	21518	21924	22330	22736
29	8555	89	300	20735	21170	21605	22040	22475	22910	23345	23780	24215	24650
30	9455	99	010	22475	22940	23405	23870	24335	24800	25265	25730	26195	26660
31	10416	109	3808	24304	24800	25296	25792	26288	26784	27280	27776	28272	28768
32	11440	119	5696	26224	26752	27280	27808	28336	28864	29392	29920	30448	30976
33	12529	130	27676	28237	28798	29359	29920	30481	31042	31603	32164	32725	33286
34	13685	142	29750	30345	30940	31535	32130	32725	33320	33915	34510	35105	35700
35	14910	155	31920	32550	33180	33810	34440	35070	35700	36330	36960	37590	38220
36	6206	168	34188	34854	35520	36186	36852	37518	38184	38850	39516	40182	40848

EXPLANAT e head column from 1 to 38, the bottom row at the end.—*Example.* To
know ho 12, and oppoſite 15, will be 2560; the ſhot contained in ſuch an oblong
finiſhed ſ

Explanation. The numbers gradually increaſing, from 2 to 91, expreſs the number of ſhot at the baſe of each ſquare pile; and the numbers oppoſite, the quantity of ſhot in each complete ſquare pile. *Example.* N°. 20 gives 2871, and N°. 30 gives 9455; and ſo of the reſt.

Rule II. Multiply the corner row, by the corner row more 1; this product by twice the corner row more 1, and divide by 6.

Example II. Let the ſide *AC* (Pl. XIII. *fig*. 2.) of a complete ſquare pile be 36; then $\frac{36 \times 37 \times 73}{6} = 6 \times 37 \times 73 = 16206$, for the required number of ſhot in that pile.

Example III. Let the ſide of a ſquare unfiniſhed pile be 25, and the corner 18; then $\frac{25 \times 26 \times 51}{6} = 25 \times 13 \times 17 = 5525$, by the firſt rule, for the content of the complete pile: now 18 taken from 25, leaves 7, and $\frac{7 \times 8 \times 15}{6} = 7 \times 4 \times 5 = 140$ for the part wanting, which taken from 5525 leaves 5385 for the number required.

Table of oblong PILES *of ſhot.*

Rule III. From three times the length of the baſe more 1, ſubtract the breadth, multiply the remainder by the product of the breadth more 1, and divide by 6.

Example IV. Let the length *AE* of a complete oblong pile be 50, and the breadth 20; then 3 times 50 more 1, and 20 ſubtracted gives 131, and $\frac{131 \times 20 \times \times 21}{6} = 131 \times 10 \times 7 = 9170$, for the number required.

To find the conduct of the oblong PILE *ABDLE*, *fig*. 4.

Example V. Let the baſe $AE = a$, and the breadth $= z$; then will $CE = a - z$. This length, multiplied by $\frac{1}{2} z \times \overline{z + 1}$, the triangular baſe *EDL*, gives $\overline{a - z} \times \frac{1}{2} z \times \overline{z + 1}$, for the priſm *CBDLE*; to which add $\frac{1}{6} z \times \overline{z + 1} \times \overline{zz + 1}$, the content of the ſquare pyramid *ABC*, we get $\overline{a - z} \times \frac{1}{2} z \times \overline{z + 1} + \frac{1}{6} z \times \overline{z + 1} \times \overline{zz + 1}$, or $\overline{3a - z + 1} \times \frac{1}{6} z \times \overline{z + 1}$, when reduced under the ſame denomination, for the content required.

Example VI. Let the length of an oblong unfiniſhed pile be 25, its breadth 9, and corner row 6; then, by the 5th example, 3 times 25 more 1 and leſs 9, gives 67 and $\frac{67 \times 9 \times 10}{6} = 67 \times 3 \times 5 = 1005$, for the complete pile: now the corner row 6 taken from the ſide 25, and breadth 9, leaves 19 and 3; then 3 times 19 more 1, leſs 3, gives 55, and $\frac{55 \times 3 \times 4}{6} = 55 \times 1 \times 2 = 110$, for the part wanting; which, taken from 1005, leaves 895 for the required number.

PINTLE, in *artillery*, a long iron bolt, fixed upon the middle of the limber bolſter, to go through the hole made in the trail-tranſom of a field-carriage, when it is to be tranſported from one place to another. See CARRIAGE.

PINTLE-*plate*, is a flat iron, through which the pintle paſſes, and nailed to both ſides of the bolſter, with 8 diamond-headed nails.

PINTLE-*waſher*, an iron ring through which the pintle paſſes, placed cloſe to the bolſter for the trail to move upon.

PINTLE-*hole*, is of an oval figure, made in the trail-tranſom of a field-carriage, wider above than below, to leave room for the pintle to play in.

PINTLE-*plates*, one above and one below the pintle-hole, with a ring at the end, nailed to the trail-tranſom, with diamond-headed nails.

PIN, an iron nail or bolt, with a round head, and generally with a hole at the end to receive a key: there are many ſorts, as axle-tree pins, or bolts, bolſter-pins, pole-pins, ſwing-tree pins, &c.

PIONEERS, in *war-time*, are ſuch as are commanded in from the country, to march with an army, for mending the ways, for working on intrenchments and fortifications, and for making mines and approaches: the ſoldiers are likewiſe employed in all theſe things.

Moſt of the foreign regiments of artillery have half a company of pioneers, well inſtructed in that important branch of duty. Our regiments of infantry and cavalry have 3 or 4 pioneers each, provided with aprons, hatchets, ſaws, ſpades, and pick-axes.

PISTOL, the ſmalleſt piece of fire-arms, uſed by the cavalry, and borne on the ſaddle-bow.

To PITCH *tents*. See TENTS.

PLACARD, } or, as it is in the original
PLAGART, } Dutch language, *Placaat*, a term uſed abroad for a proclamation, edict, &c. put up in all public places, by government authority; whereby their ſubjects are ordered to do, or forbear, ſomething expreſſed therein.

PLACE, in *fortification*, ſignifies in general terms a fortified town, a fortreſs: hence we ſay it is a ſtrong place.

PLACE *of arms in a town*, a place left near its centre, where generally the grand guard is placed. In towns regularly fortified, the place of arms ſhould be in the centre. In this place the ſoldiers of the garriſon parade, form, and mount guard, &c.

PLACE *of arms of an attack, or of a trench*, are deep trenches 15 or 18 feet wide, joining the ſeveral attacks together: they ſerve to place the guard of the trenches in, to be at hand to ſupport the workmen when attacked. It is cuſtomary to make 3 places of arms, when the ground will permit: the firſt, and moſt diſtant from the place, is about 300 toiſes from the glacis of the covert-way; the ſecond is within 140 toiſes; and the third at the foot of the glacis. See PARALLELS.

PLACE *of arms of a camp*, is, ſtrictly ſpeaking, the bell-tents, at the head of each company, where the arms are lodged; likewiſe a place choſen at the head of the camp for the army to form in line of battle, for a review, or the like.

PLACE *of arms of the covert-way*, is a part of it, oppoſite to the re-entering angle of the counterſcarp, projecting outwards in an angle.

PLAN, *ground plot*, or *ichnography*, in *fortification*, is the repreſentation of the firſt or fundamental tract of a work, ſhowing the length of its lines, the quantity of its angles, the breadth of the ditches, thickneſs of the rampart and parapets, and the diſtance of one part from another: ſo that a plan repreſents a work, ſuch as it would appear if cut equal with the level of the horizon, or cut off at the foundation: but it marks neither the heights nor depths of the ſeveral parts of the works: this is properly *profile*, which expreſſes only the heights, breadths, and depths, without taking notice of the lengths. As architects, before they lay the foundation of their edifice, make their deſign on paper, by which means they find out their faults; ſo an engineer, before tracing his works on the ground, ſhould make *plans* of his deſigns upon paper, to the end he may do nothing without ſerious deliberation.

Exact plans are very uſeful for generals or governors, in either attacking or defending a place, in chuſing a camp, determining attacks, conducting the approaches, or in examining the ſtrength and weakneſs of a place; eſpecially ſuch plans as repreſent a place with the country about it, ſhowing the rivers, fountains, marſhes, ditches, valleys, mountains, woods, houſes, churches, defiles, roads, and other particulars, which appertain to it.

PLANKS. See MADRIERS.

PLATES, or *priſe-plates*, in *artillery*, two plates of iron on the cheeks of a gun-carriage, from the cope-ſquare to the centre, through which the priſe-bolts go, and on which the hand-ſpikes reſt, when uſed in raiſing the breech of the gun, &c.

Breaſt-PLATES, the two plates on the face of the carriage, on the other cheek.

Train-PLATES, the two plates on the cheeks at the train of the carriage.

Dulidge-PLATES, the ſix plates on the wheel of a gun-carriage, where the fellies are joined together.

PLATFORM, in *gunnery*, is a bed of wood on a battery, upon which the guns ſtand; each conſiſting of 18 planks of oak or elm, a foot broad, 2½ inches thick, and from 8 to 15 feet long, nailed or pinned on 4, 5, or 6 beams, from 4 to 7 inches ſquare, called ſleepers. They muſt be made higher behind than before by 6 or 9 inches, to prevent too great a recoil, and to advance the gun eaſy when loaded. They are from 18 to 20 feet long, 8 feet before and 14 or 15 feet behind, and the direction left to the officers of the royal regiment of artillery.

PLATOON, in *military affairs*, a ſmall body of men, in a battalion of foot, &c. that fire alternately. A battalion is generally divided into 16 platoons, excluſive of the grenadiers, which form 2 or 4 platoons more, as occaſion may require.

PONIARD, a ſort of ſhort ſword, uſed in Spain, Portugal, and Italy.

POINT-BLANK, *of a gun*, is the diſtance ſhe throws a ſhot in a ſuppoſed direct line; the gun being laid at no elevation, but levelled parallel to the horizon. We ſay, ſuppoſed direct line, becauſe it is certain, and eaſily proved, that a ſhot cannot fly any part of its range in a right line ſtrictly taken; but the greater the velocity, the nearer it approaches to a right line; or the leſs crooked its range.

POINTING *of a gun or mortar*, is the placing either one or other, ſo as to hit the object, or to come as near it as poſſible.

POLE, in a 4-wheel carriage, is faſtened to the middle of the hind axle-tree, and paſſes between the fore axle-tree and its bolſter, faſtened with the pole-pin, ſo as to move about it, and faſtens the fore and hind carriages together.

POLYGON, is a figure of more than four ſides, and is either regular or irregular, exterior or interior.

Regular POLYGON, is that whoſe angles and ſide are equal. It has an angle of the centre, and an angle of the polygon. The centre of a regular

gular polygon, is the centre of a circle, which circumſcribes the polygon; that is, whoſe circumference paſſes through all the angles of the figure.

Irregular POLYGON, is that whoſe ſides and angles are unequal.

Exterior POLYGON, that whoſe lines touch the points of the flanked angles, when a place is fortified inwards.

Interior POLYGON, that outward fortification which makes the angles of the gorge; ſo that the whole baſtion is without the polygon.

PONT *de jonc*, or *Pont volant*. See BRIDGE.

PONTOON, in *war*, a kind of flat-bottomed boat, whoſe carcaſs of wood is lined within and without with tin: they ſerve to lay bridges over rivers for the artillery and army to march over. The French pontoons, and thoſe of moſt other powers, are made of copper on the outſide: though they coſt more at firſt, yet they laſt much longer than thoſe of tin; and, when worn out, the copper ſells nearly for as much as it coſt at firſt; but when ours are rendered uſeleſs, they ſell for nothing. Our pontoons are 21 feet long, 5 feet broad, and depth within 2 feet 1.5 inches.

PONTOON-*carriage*, is made with two wheels only, and two long ſide-pieces, whoſe fore ends are ſupported by a limber; and ſerves to carry the pontoon, boards, croſs timbers, anchors, and every other thing neceſſary for making a bridge.

PONTOON-*bridge*, is made of pontoons, ſlipped into the water, and placed about 5 or 6 feet aſunder; each faſtened with an anchor, when the river has a ſtrong current, or to a ſtrong rope that goes acroſs the river, running through the rings of the pontoons. Each boat has an anchor, cable, baulks, and cheſts. The baulks are about 5 or 6 inches ſquare, and 21 feet long. The cheſts are boards joined together by wooden bars, about 3 feet broad, and 12 feet long. The baulks are laid acroſs the pontoons at ſome diſtance from one another, and the cheſts upon them joined cloſe; which makes a bridge, in a very ſhort time, capable of ſupporting any weight.

PORT-*cullice*, in *fortification*, is an aſſemblage of ſeveral large pieces of wood, joined acroſs one another like a harrow, and each pointed with iron at the bottom. They are ſometimes hung over the gate-way of old fortified towns, ready to let down in caſe of a ſurpriſe, when the gates could not be ſhut.

PORT-*fire*, in *artillery*, a compoſition put in a paper caſe to fire guns and mortars, inſtead of a lint-ſtock and match. See LABORATORY WORKS.

POST, in *war*, any ſort of ground, fortified or not, where a body of men can be in a condition of reſiſting the enemy.

Advanced POST, a ſpot of ground, ſeized by a party to ſecure their front, and the poſts behind them.

POST *of honour*. The advanced guard is a poſt of honour: the right of the two lines is the poſt of honour, and is always given to the eldeſt regiment: the left is the next poſt, and is given to the next eldeſt, and ſo on. The centre of the lines is the poſt the laſt honourable, and is given to the youngeſt regiments. A ſentinel placed before the colours, and at the door of the commanding officer, is a poſt of honour.

POSTERN, more frequently called a ſally-port, is a ſmall door in the flank of a baſtion, or other part of a garriſon, to march in and out unperceived by an enemy, either to relieve the works, or make ſallies.

POUCH, in a *military ſenſe*, is a ſquare caſe or bag of leather, with a flap over it, pendent to a buff ſhoulder-belt, of about 3 inches broad, and hangs over the left ſhoulder of the infantry: its uſe is to hold cartridges, &c. They are made of the ſtouteſt, blackened calf-ſkin, eſpecially the outſide flaps, which ſhould be of ſuch a ſubſtance, as to turn the ſevereſt rain. The cartridge-boxes in the inſide of the pouches, to be made as light as poſſible, with 36 holes in each, in order to prevent the addition of boxes to buckle round the waiſt, which has often been productive of miſchief and confuſion, by blowing-up.

POUNDER, in *artillery*, is uſed to ſpecify a certain caliber: thus a 24-pounder, a 12 or a 6-pounder, are thoſe pieces whoſe balls weigh 24, 12, or 6 pounds.

POWDER. See GUN-POWDER.

POWDER-*magazine*, a bomb-proof arched building to hold the powder in fortified places, &c. containing ſeveral rows of barrels laid one over another. See MAGAZINE.

POWDER-*cart*, a two-wheel carriage, covered with an angular roof of boards; and, to prevent the powder from dampings, a tarred canvaſs is put over the roof: on each ſide are lockers to hold ſhot, in proportion to the quantity of powder, which is generally four barrels.

POWDER-*mill*, where the materials are beat, mixed together, and grained: they are placed near rivers, and as far from any houſe as can be, for fear of accidents, which often happen. See MILL.

POZOLANA. See MORTAR.

PRACTICE, or *gun-practice*. In the ſpring, as ſoon as the weather permits, the exerciſe of the great guns begins, with an intention to ſhow the gentlemen cadets at the royal military academy at Woolwich, and private men, the manner of laying, loading, pointing, and firing the guns. Sometimes inſtruments are uſed to find the centre line, or two points, one at the breech, the other at the muzzle, which are marked with chalk, and whereby the piece is directed to the target: then a quadrant is put into the mouth, to give the gun the required elevation, which at firſt is gueſſed at, according to the diſtance the target is from the piece. When the piece has been fired, it is ſponged, to clear it from any duſt or ſparks of fire that might remain in the bore, and loaded: then the centre line is found, as before; and if the ſhot went too high, or too low, to the right or to the left, the elevation and trail are altered accordingly. This practice continues morning and evening for about ſix weeks, more or leſs, according as there are a greater or leſs number of recruits. In the mean time others are ſhown the motions of quick firing with field-pieces.

Mortar-PRACTICE, generally thus: a line of 1500 or 2000 yards is meaſured in an open ſpot of ground, from the place where the mortars ſtand, and a flag fixed at about 300 or 500 yards: this being done, the ground where the mortars are to be placed is prepared and levelled with ſand, ſo that they may lie at an elevation of 45 degrees; then they are loaded with a ſmall quantity of powder at firſt, which is increaſed afterwards, by an ounce every time, till they are loaded with a full charge: the times of the flights of the ſhells are obſerved, to determine the length of the fuzes. The intention of this practice is, when a mortar-battery is raiſed in a ſiege, to know what quantity of powder is required to throw the ſhells into the works at a given diſtance, and to cut the fuzes of a juſt length, that the ſhell may burſt as ſoon as it touches the ground.

PRAME, in *military hiſtory*, a kind of floating battery, being a flat-bottomed veſſel, which draws little water, mounts ſeveral guns, and is very uſeful in covering the diſembarkation of troops. They are generally made uſe of in tranſporting the troops over the lakes in America.

PRIEST's-*cap*. See FORTIFICATION, and BONNET.

PRIMING, in *gunnery*, is the gun-powder put into the pan of ſmall arms, and into the vent of cannon, that the powder may thereby be inflamed.

PRISONERS *of war*, thoſe of the enemy who are taken in or after a battle, ſiege, &c.: they are deprived of their liberty at large, until exchanged.

PROFILE, in *fortification*, is the repreſentation of a vertical ſection of a work, and ſerves to ſhow thoſe dimenſions which cannot be repreſented in plans, but are yet neceſſary in the building of a fortification: they are beſt conſtructed on a ſcale of 30 feet to an inch. See Pl. XIV. *fig.* 1, 2, 3, 4, 5, &c.

PROOF *of artillery and ſmall arms*, is a trial whether they will ſtand the quantity of powder allotted for that purpoſe. The rule of the board of ordnance is, that all guns, under 24-pounders, be loaded with powder as much as their ſhot weighs; that is, a braſs 24-pounder with 21 lb. a braſs 32-pounder with 26 lb. 12 oz. and a 42-pounder with 31 lb. 8 oz.; the iron 24-pounder with 18 lb. the 32-pounder with 21 lb. 8 oz. and the 42-pounder with 25 lb.

The braſs light field-pieces are proved with powder that weighs half as much as their ſhot, except the 24-pounder, which is loaded with 10 lb. only.

Government allows 11 bullets of lead in the pound for the proof of muſkets, and 14.5, or 29 in two pounds, for ſervice; 17 in the pound for the proof of carabines, and 20 for ſervice; 28 in the pound for the proof of piſtols, and 34 for ſervice.

When guns of a new metal, or of lighter conſtruction, are proved, then, beſides the common proof, they are fired 2 or 300 times, as quick as they can be, loaded with the common charge given in actual ſervice. Our light 6-pounders were fired 300 times in 3 hours 27 minutes, loaded with 1 lb. 4 oz. without receiving any damage.

PROOF *of powder*, is in order to try its goodneſs and ſtrength. There have been different inventions propoſed and put in practice heretofore, for the proof of powder. See GUN-POWDER.

PROOF *of cannon*, is made to aſcertain their being well caſt, their having no cavities in their metal, and, in a word, their being fit to reſiſt the effort of their charge of powder. In making this proof, the piece is laid upon the ground, ſupported only by a piece of wood in the middle, of about 5 or 6 inches thick, to raiſe the muzzle a little; and then the piece is fired againſt a ſolid butt of earth.

Tools to PROVE *cannon are as follow:*

Searcher, is an iron ſocket with branches, from 4 to 8 in number, bending outwards a little, with ſmall points at their ends: to this ſocket is fixed a wooden handle, from 8 to 12 feet long, and 1½ inch in diameter. This ſearcher is introduced into the gun after each firing, and turned gently round to diſcover the cavities within: if any are found, they are marked on the outſide with chalk; and then the

Searcher with one point is introduced, about which point a mixture of wax and tallow is put, to take the impreſſion of the holes; and if any are found of ¼ of an inch deep, or of any conſiderable length, the gun is rejected as unſerviceable to the government.

Reliever, is an iron ring fixed to a handle, by means of a ſocket, ſo as to be at right angles: it ſerves to diſengage the firſt ſearcher, when any of its points are retained in a hole, and cannot otherwiſe be got out. When guns are rejected by the proof-maſters, they order them to be marked × thus, which the contractors generally alter *WP* thus, and after ſuch alteration, diſpoſe of them to foreign powers for Woolwich proof.

The moſt curious inſtrument for finding the principal defects in pieces of artillery, was lately invented by lieutenant-general Deſaguliers, of the royal regiment of artillery. This inſtrument, grounded on the trueſt mechanical principles, is no ſooner introduced into the hollow cylinder of the gun, than it diſcovers its defects, and more particularly that of the piece not being truely bored, which is a very important one, and to which moſt of the diſaſters happening to pieces of artillery, are in a great meaſure to be imputed; for, when a gun is not truely bored, the moſt expert artillereſt will not be able to make a good ſhot. *See the following tables.*

Weight of powder for PROOF, *ſervice, and ſcaling braſs and iron guns.*

Pounders	Braſs guns																	
	Heavy						Medium						Light					
	Proof		Service		Scaling		Proof		Service		Scaling		Proof		Service		Scaling	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
42	31	8	21	0	3	4												
32	26	12	16	0	2	12												
24	21	0	12	0	2	0	18	0	9	0	2		10	0	5	0	2	
18	18	0	9	0	1	8												
12	12	0	6	0	1	0	9	0	4	0	1		6	0	3	0	1	
9	9	0	4	8	0	12												
6	6	0	3	0	0	8	6	0	3 or 2	0 8		8	3	0	1	8		8
4	4	0	2	0	0	6												
3	3	0	1	8	0	4	3	0	1	8		4	1	8	0	12		4
2	2	0	1	0	0	3												
1½	1	8	0	12	0	2												
1	1	0	0	8	0	1½												
½	0	8	0	4	0	1												

Pounders	Iron guns																	
	Heavy						Medium						Light					
	Proof		Service		Scaling		Proof		Service		Scaling		Proof		Service		Scaling	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
42	25	0	17	0	3	4							22	3	14		3	4
32	21	8	14	0	2	12							19	1	10	10	2	12
24	18	0	11	0	2	0							16		8		2	
18	15	0	9	0	1	8							13	5	6		1	8
12	12	0	6	0	1	0							10	10	4		1	
9	9	0	4	8	0	12							8	8	3			12
6	6	0	3	0	0	8	4	0	2	0		8	5	5	2			8
4	4	0	2	0	0	6							3	8	1	10		6
3	3	0	1	8	0	4							2	10	1			4
2	2	0	1	0	0	3							1	12		10		3
1½	1	8	0	12	0	2							1	5		7		2
1	1	0	0	8	0	1½								14		4½		1½
½	0	8	0	4	1	1								7		2¼		1

Proof *of mortars and howitzers*, is made to aſcertain their being well caſt, and of ſtrength to reſiſt the effort of their charge. For this purpoſe the mortar or howitzer is placed upon the ground, with ſome part of their trunnions or breech ſunk below the ſurface, and reſting on wooden billets, at an elevation of about 70 degrees.

The mirror is generally the only inſtrument to diſcover the defects in mortars and howitzers. In order to uſe it, the ſun muſt ſhine; the breech muſt be placed towards the ſun, and the glaſs over-againſt the mouth of the piece: it illuminates the bore and chamber ſufficiently to diſcover the flaws in it. See the following table.

Weight of powder for PROOF, *ſcaling, and blowing of mortars, howitzers, royals, and coehorns, &c.*

Nature	Proof		Scaling		blowing		Shells contain powder			Cham contain powder		Shells weight
inches	lb.	oz.	oz.	dr.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	lb.
13 S.	30	0	2	0	2	0	9	4	8	33	0	198
10 S	10	4	1	0	1	0	4	14	12	12	8	93
13 L	9	8	2	0	2	0	9	4	8	9	1	194
10 L.	3	14	1	0	1	0	4	14	12	4	0	90
8 L.	2	0	1	0	1	0	2	3	8	2	1	46
5½ R.	0	9	0	12	0	12	1	1	8	1	0	16
4⅖ C.	0	4½	0	8	0	8	0	8	0	0	8	9
10 H.	4	0	1	8	1	8	4	14	12	4	0	90
8 H.	3	8	1	0	1	0	2	3	8	2	0	46
5½ H.	1	0	0	12	0	12	1	1	8	1	0	16
4⅖ H.	0	8	0	8	0	8	0	8	0	0	8	8

N. B. S. ſtands for ſea-mortar, L. for land-mortar, R. for royal, C. for coehorn, and H. for howitzer. The weight of the ſhells, and quantity of powder to fill them, differ ſometimes conſiderably.

Proof *of ſmall arms with leaden balls.*

Nature of pieces	Balls for proof		Balls for ſervice.		Wt. of powder in ſervice
	N°. in 1 lb.	Wt. of each	N°. in 1 lb.	Wt. of each.	
Wall-piece	6	oz. dr. 2 8	$6\frac{2}{5}$	oz. dr. 2 8	oz. dr. 0 12
Muſket	11	1 $7\frac{3}{11}$	$14\frac{1}{2}$	1 $1\frac{19}{29}$	0 6
Carbine	17	0 $15\frac{1}{17}$	20	0 $12\frac{4}{5}$	0 $4\frac{1}{2}$
Piſtol	28	0 $9\frac{1}{7}$	34	0 $7\frac{9}{17}$	0 $2\frac{1}{2}$

N. B. In the proof of all ſorts of ſmall arms, the quantity of powder uſed is the weight of the ball exactly.

Proof *of foreign braſs artillery.*

1ſt. The *Pruſſians.* Their battering-train and garriſon artillery are proved with a quantity of powder equal to ½ the weight of the ſhot, and fired 75 rounds as faſt as in real ſervice; that is, 2 or 3 rounds in a minute.

Their light field-train, from a 12-pounder upwards, are proved with a quantity of powder = 1-3d of the weight of the ſhot, and fired 150 rounds, at 3 or 4 rounds in a minute. From a 12-pounder downwards, are proved with a quantity of powder = 1-5th of the ſhot's weight, and fired 300 rounds, at 5 or 6 rounds each minute, properly ſponged and loaded.

Their mortars are proved with the chambers full of powder, and the ſhells loaded. Three rounds are fired as quick as poſſible.

2d. The *Dutch* prove all their artillery by firing each piece 5 times; the two firſt rounds with a quantity of powder = 2-3ds of the weight of the ſhot; and the three laſt rounds with a quantity of powder = ½ the weight of the ſhot.

3d. The *French* the ſame as the Dutch.

4th. The *Portugueſe* prove their artillery as follows, viz.

42	Pounders, 6 rounds	1ſt ſhot 30lb.	then diminiſhing 2lb. each round
32		1ſt ſhot 26lb.	
24		1ſt ſhot 18lb.	
12	Pounders, 6 rounds	1ſt ſhot 10lb.	dimin. 1lb. each round
6		1ſt ſhot 5lb.	——— ½lb. each round
3		1ſt ſhot 2½lb.	——— ¼lb. each round

They are only fired once in every minute.

Their mortars are proved by filling the chambers full of powder, a loaded ſhell, and the mortar rammed full of earth.

PROJECTILES, are ſuch bodies as, being put in a violent motion by any great force, are then caſt off, or let go from the place where they received their quantity of motion; as a ſhell or ſhot from a piece of artillery, a ſtone thrown from a ſling, or an arrow from a bow, &c. This line is commonly taken for a parabola, and the ranges are computed from the properties of that curve. The aſſumption would be juſt, in caſe the ball, in its motion, met with no reſiſtance: but, the reſiſtance of the air to ſwift motions being very great, the curve deſcribed by the ſhot is neither a parabola, nor near it: and by reaſon of the reſiſtance, the angle which gives the greateſt amplitude is not 45 degrees, as commonly ſuppoſed, but ſomething leſs, probably 43½. Hence the ſublime mathematics are abſolutely neceſſary in the inveſtigation of the track of a ſhell or ſhot in the air, known by the name of *military projectiles.*

Galileus having diſcovered that bodies projected in vacuo, and in an oblique direction to the horizon, do always deſcribe a parabola; it was obſervable, that this doctrine was not ſufficient to determine the real motion of a military projectile: for ſince ſhells and ſhot move with a great velocity, the reſiſtance of the air becomes ſo great with reſpect to the weight of the projectile, that its effect turns the body very conſiderably from the parabolic tract; ſo that all calculations, grounded on the nature of this curve, are of little uſe on theſe occaſions. This is not to be wondered at, ſince Galileus, in his enquiry, paid no regard to any other force acting on bodies, than the force of gravity only, without conſidering the reſiſtance of the air.

Every body, moving in a fluid, ſuffers the action of two forces: the one is the force of gravity, or the weight of the body; and it is to be obſerved, that this weight is leſs than the natural weight of the body, that being diminiſhed by an equal bulk of the fluid in which the body moves. The other force is that of the reſiſtance, which is known to be proportional to the ſquares of the velocity of the body; and when the body is a globe, as is commonly ſuppoſed, the direction of this force is diametrically oppoſite to that of the motion of the body. This force changes continually, both in quantity and direction; but the firſt force remains conſtantly the ſame. Hence, the point in queſtion is, to determine the curve which a body projected obliquely, muſt deſcribe when acted upon by the two forces juſt now mentioned.

Although

Although this queſtion is eaſily reduced to a problem purely analytical, the great Newton, notwithſtanding his ingenious endeavours, did not arrive at a complete ſolution of it. He was the firſt who attempted it, and having ſucceeded ſo well in the ſuppoſition, that the reſiſtance is proportional to the velocity, it is almoſt inconceivable that he did not ſucceed, when the reſiſtance is ſuppoſed proportional to the ſquares of the velocity, after ſolving a number of queſtions incomparably more difficult. The late Mr. John Bernoulli gave the firſt ſolution of this problem, from which he drew a conſtruction of the curve, by means of the quadratures of ſome tranſcendent curves, whoſe deſcription is not very difficult.

This great problem was, therefore, very well ſolved long ago; yet the ſolution, however good in theory, is ſuch as has hitherto been of no uſe in practice, nor in correcting the falſe theory grounded on the parabola, to which the artilleriſt is ſtill obliged to adhere, notwithſtanding he knows it to be inſufficient. It is certain, that that ſolution has been of no real advantage towards improving the art of gunnery: it has only ſerved to convince the ſtudent in that art, of the error of his principles, drawn from the nature of the parabola, although he is ſtill to abide by them. It is indeed ſomething, to know that the common rules are erroneous; but unleſs we know how much they err in any caſe, the advantage is very little.

One may think it a work of infinite labour to eſtabliſh rules for the flight of cannon-ſhot, agreeable to the real curve which a body deſcribes in the air: for although, according to the hypotheſis of Galileus, we want only the elevation of the piece, and the initial velocity, and it is therefore not difficult to calculate tables to ſhow the greateſt height of the projectile, and the point where it muſt fall in any propoſed caſe; yet in order to calculate ſimilar tables according to the true hypotheſis, care muſt be taken, beſides the two particulars already mentioned, to have reſpect as well to the diameter of the projectile as to its weight: therefore the practitioner will be reduced to the neceſſity of calculating tables, as well for the diameter of each projectile, as for its weight; and the execution of ſuch a work would be almoſt impracticable. We therefore refer the curious to Mr. Euler's *True Principles of Gunnery*, tranſlated, with many neceſſary explanations and remarks, by the very learned and ingenious Hugh Brown, eſq;.

That the reader may have a clear conception of the different concluſions deduced from this, and from the common theory, I ſhall here ſubjoin a table of the greateſt range, and the ranges at 45 degrees by this theory; and alſo the ranges at 45 degrees by the common theory; the initial velocity being the ſame.

Compariſon of the ranges by this theory, with thoſe determined by the common theory, which ſuppoſes a vacuum, the initial velocity being given, &c.

Velocity per ſecond in feet	For the greateſt range by this theory						Range at 45° by this theory			Range at 45° in vacuo
	12¾-inch ſhell		9¾-inch ſhell		7¾-inch ſhell					
	Limits of elevation between	Range in feet ſomething more than	Limits of elevation between	Range in feet ſomething more than	Limits of elevation between	Range in feet ſomething more than	12¾-in ſhell	9¾-inch ſhell	7¾-inch ſheil	Feet
	° ′ ″ ° ′ ″		° ′ ″ ° ′ ″		° ′ ″ ° ′ ″					
600	40 0 15 & 43 12 35	6748.040	39 33 5 & 41 6 53	6098.36	39 4 9 & 41 6 53	5646.94	6680.505	6061.82	5582.62	11191.7
900	39 4 9 40 32 18	10631.57	36 37 1 38 0 26	9446.72	35 5 21 36 27 33	8405.97	10370.06	9218.50	8206.39	25181.3
1200	34 27 40 36 27 33	13928.49	33 44 52 35 38 12	12301.48	33 44 52 35 2 58	10581.91	13442.88	11530.65	9987.27	44766.8
1500	33 44 52 35 2 58	16558.45	33 16 6 34 33 35	14085.96	32 27 50 34 33 35	12303.43	15629.30	13494.96	11695.36	69948.2
1800	32 27 50 34 33 35	18762.77	30 48 50 32 51 59	15854.64	30 48 50 31 54 56	13685.41	18114.09	14712.06	12403.80	100725.4
2200	30 48 50 32 51 39	20706.91	30 48 50 31 54 56	17816.56	29 53 5 31 4 15	14847.49	19337.07	16012.82	13782.98	137098.4
2400	30 48 50 31 54 56	22129.69	29 0 9 31 4 15	18468.56	29 0 9 31 4 15	16026.99	20613.40	17139.99	14436.90	199067.3
2700	29 53 5 31 4 15	23604.66	29 0 9 31 4 15	19787.96	—	—	21889,72	18018.94	—	226632.2

Experiments intended to try the ranges computed by this theory, with thoſe determined by the common theory, at Gibraltar, in 1766, communicated to me by Capt. Jardine.

10-inch howitzer

Weight 30 C. Weight ſhell 90lb.
Length of chaſe 28½ in. Length chamb. 16½ in.
Diam. chamber 6.65 Windage .3 inches.

Elevation	Powder		Ranges real	Mediums	Should be by the new theory.	Should be by the parabola
°	lb.	oz.	yards	yards	yards	yards
45	2 2		967 970	968½	916	1028
	1	12	816 826 845 836	830	772	880
	1	8	670 718 637 662 666	660	600	640
9	2		318 324 302	314	330	294
	1	12	270 250 292	270	290	250
12	1	8	271 259 251 263	260	285	254

.8-inch howitzer

Wt. howitzer 11¾ C. Weight of ſhell 48 lb.
Length chaſe 25½ in. Length chamb. 9½ in.
Diam. chamb. 4.8 in. Windage .3 inches.

Elevation	Powder		Ranges real	Mediums	Should be by the new theory	Should be by the parabola.
°	lb.	oz.	yards	yards	yards	yards
45	1		1000 935 1020	985	941	1102
		14	794 880	837	800	920
		12	718 670 672 662 695 685	683	635	690
9	1		361 356 307	340	356	300
		14	287 297 265	283	290	256
12		12	274 300 280 276	280	248	276

In theſe experiments, from the ranges at 45 degrees elevation, it was calculated what thoſe at 9° and 12° ſhould be; and from thoſe lower elevations, what the higher ſhould be: firſt by Mr. Robins's theory in column fifth, then by the uſual way, ſuppoſing the curve a parabola, in the laſt column.

It muſt be confeſſed that theſe experiments are not ſo deciſive as could be wiſhed, for want of time, and of a ſufficient range, &c. to give a fair trial to Mr. Robins's principles; for, as the ranges increaſe, the errors of the parabolic theory would likewiſe increaſe; which, in Mr. Robins's method, probably is not the caſe: but a more ſimple and leſs tedious manner of applying it to practice is ſtill wanting; which perhaps might be done by the help of more tables, &c.

Military PROJECTILE *demonſtrated.* Let (*fig.* 1. Pl. XIII.) *CNAMH* be the curve deſcribed by a globe in any fluid; and let *a* denote the accelerate force of gravity, and let *c* be the retardive force of the reſiſtance. Let *A* be the higheſt point of the curve, and the horizontal line *BAE* a tangent in that point. *CAN* will be a portion in that curve, by which the globe aſcends, and *AMH* that by which it deſcends. Let us conſider ſeparately the motion in the aſcent and deſcent; and for the deſcent, let any abſciſſa taken on the horizontal line $AP = x$,

, and the correſponding vertical ordinate $PM = y$; and let v denote the diſtance a body muſt fall freely to acquire the velocity of the globe at M, and the retardive force of reſiſtance at M will be $= \frac{v}{c}$.

Reſolving the motion of the body into the horizontal direction AP, and the vertical direction PM, this will be accelerated by the accelerative force of gravity a. The retardive force of the reſiſtance $\frac{v}{c}$ acting in the direction of the tangent MT, if we put the fluxion of the curve $Mm = \dot{S}$, there will reſult a force which oppoſes the horizontal motion $= \frac{v\dot{x}}{c\dot{S}}$ Therefore, if the fluxion of the time be denoted by $\dot{t}$, ſo $\dot{t} = \frac{\dot{S}}{\sqrt{v}}$, and $\dot{t}$ be ſuppoſed conſtant, the mechanical principles of acceleration furniſh theſe two equations: $\frac{2\ddot{x}}{\dot{t}^2} = -\frac{v\dot{x}}{c\dot{S}}$; and $\frac{2\ddot{y}}{\dot{t}^2} = a - \frac{v\dot{y}}{c\dot{S}}$.

Since $\dot{t} = \frac{\dot{S}}{\sqrt{v}}$, we have $v = \frac{\dot{S}^2}{\dot{t}^2}$, whence the foregoing equations become: $\frac{2\ddot{x}}{\dot{t}^2} = -\frac{\dot{x}\dot{S}}{c\dot{t}^2}$, and $\frac{2\ddot{y}}{\dot{t}^2} = a - \frac{\dot{y}\dot{S}}{c\dot{t}^2}$. Suppoſe $\dot{y} = p\dot{x}$, ſo that p denote the tangent of the angle PTM, or of the inclination of the globe's motion to the horizon; then becauſe $\dot{S} = \dot{x}\sqrt{1+p^2}$, and $\ddot{y} = p\ddot{x} + \dot{x}\dot{p}$, we ſhall have theſe two equations: $\frac{2\ddot{x}}{\dot{t}^2} = -\frac{\dot{x}^2\sqrt{1+p^2}}{c\dot{t}^2}$, and $\frac{2p\ddot{x}}{\dot{t}^2} + \frac{2\dot{x}\dot{p}}{\dot{t}^2} = a - \frac{p\dot{x}^2\sqrt{1+p^2}}{c\dot{t}^2}$; and the firſt multiplied by p, and taken from the laſt, leaves $\frac{2\dot{x}\dot{p}}{\dot{t}^2} = a$, or $a\dot{t}^2 = 2\dot{x}\dot{p}$; and ſince the firſt gives $-\frac{2\ddot{x}}{\dot{x}^2} = \frac{\sqrt{1+p^2}}{c}$, we find $v = \frac{\dot{x}^2 \times \overline{1+p^2}}{\dot{t}^2}$

$c\ \dot{x} \times 1 p^2$

Becauſe $2\dot{p} = \frac{a\dot{t}^2}{\dot{x}}$; the other equation $-\frac{2\ddot{x}}{\dot{x}^2} = \frac{\sqrt{1+p^2}}{c}$, multiplied by $\dot{p}$, is reduced to $-\frac{2a\dot{t}^2\ddot{x}}{\dot{x}^3} = \frac{2\dot{p}\sqrt{1+p^2}}{c}$, whoſe fluent, $\dot{t}$ being conſtant, is $\frac{a\dot{t}^2}{\dot{x}^2} = \frac{2\dot{p}}{\dot{x}} = 2C + \frac{2}{c}$ into the fluent of $\dot{p}\sqrt{1+p^2}$; from which we deduce $\dot{x} = \frac{\dot{p}}{C + \frac{1}{c} \times \text{fluent of } \dot{p}\sqrt{1+p^2}}$ and $\dot{y} = \frac{p\dot{p}}{C + \frac{1}{c} \times \text{fluent of } \dot{p}\sqrt{1+p^2}}$; therefore $\dot{S} = \dot{x}\sqrt{1+p^2} = \frac{\dot{p}\sqrt{1+p^2}}{C + \frac{1}{c} \times \text{fluent of } \dot{p}\sqrt{1+p^2}}$. Finally, becauſe $a\dot{t}^2 = 2\dot{x}\dot{p}$, we ſhall have $\frac{1}{2}a\dot{t}^2 = \frac{\dot{p}^2}{C + \frac{1}{c} \times \text{fluent of } \dot{p}\sqrt{1 \times p^2}}$, and $\dot{t}\sqrt{\tfrac{1}{2}a} = \frac{\dot{p}}{\sqrt{C + \frac{1}{c} \times \text{fluent of } \dot{p}\sqrt{1+p^2}}}$, and, finally, for the velocity $v = \frac{\frac{1}{2}a \times \overline{1+p^2}}{C + \frac{1}{c}\,\text{fluent of } \dot{p}\sqrt{1+p^2}}$.

It is evident, that the expreſſive fluent of $\dot{p}\sqrt{1+p^2}$ in the foregoing equations, expreſſes a parabolic arc; or it may be aſſigned by logarithms, ſince the fluent of $\dot{p}\sqrt{1+p^2} = \frac{1}{2}p\sqrt{1+p^2} + \frac{1}{2}\log.\ p + \sqrt{1+p^2}$; taking the fluent ſo that it may vaniſh when $p = 0$, which is the caſe at the vertex of the curve, where the tangent is horizontal: therefore, ſuppoſing the angle of the inclination of the body's motion to the horizon, whoſe tangent is $= p$, to be known at the point M, we find the abſciſſa $AP = x$, the ordinate $PM = y$, the arc $AM = s$, the height anſwering to the velocity at M, and finally the time of deſcribing the arc AM.

Put the quantity C, which is introduced into the fluent, equal to the fraction $\frac{n}{c}$, it is manifeſt, that n denotes an abſtract number. Let, for brevity ſake, the fluent of $\dot{p}\sqrt{1+p^2} = P$. Since the value of P is eaſily found for every value of p, we ſhall have the following equations for the branch AMH, by which the body deſcends: $x = c \times$ fluent of $\frac{\dot{p}}{n+P}$; $y = c \times$ fluent of $\frac{p\dot{p}}{n+P}$, $S = c \times$ fluent of $\frac{\dot{p}\sqrt{1+p^2}}{n+P}$; $\dot{t}\sqrt{\tfrac{1}{2}a} = \frac{\dot{p}\sqrt{c}}{\sqrt{n+P}}$, or $t = \frac{\sqrt{2c}}{\sqrt{a}} \times$ fluent of $\frac{}{\sqrt{n+P}}$ and $v = \frac{\frac{1}{2}ac \times \overline{1+p^2}}{n+P}$. Theſe fluents are to be taken ſo, that they may vaniſh in the caſe where $p = o$; whence it appears that the height anſwering to the velocity at A will be $= \frac{ac}{2n}$.

The ſame equations ſerve to expreſs the nature of the other branch ANC, which the body deſcribes in its aſcent, by taking the value of P negative: therefore, if the direction of the motion at N make, with the horizontal line, an angle whoſe tangent is p, we ſhall have $AQ = c \times$ fluent of $\frac{\dot{p}}{n-P}$; $QN = c \times$ fluent of $\frac{p\dot{p}}{n-P}$ $AN = c \times$ fluent of $\frac{p\sqrt{1+p^2}}{n-P}$; and the time of deſcribing the arc $AN = \frac{\sqrt{2c}}{\sqrt{a}} \times$ fluent of $\frac{}{\sqrt{n-P}}$, and the height anſwering to the velocity at N $\frac{\frac{1}{2}ac \times 1+p^2}{n-P}$. Whence it is evident, that in the aſcending branch ANC, the inclination of the tangent to the horizon can no where become ſo great, that P ſhall be greater than n, and that when $P = n$ the velocity of the body is infinite.

The velocity of the body, and $CNAMH$ which it deſcribes, depend on three conſtant quantities, a, c, and n; whoſe values muſt be found for every caſe propoſed. The firſt, a, is determined from the relation of the ſpecific gravity of the fluid to that of the globe; and ſince it does not come into the expreſſions which determine the nature of the curve, that will be known independent of a: it is only the time and velocity which depend upon it. The quantity c is found by means of the diameter and weight of the globe; and, as it is uſed only as a multiplier, it cauſes no difficulty in the calculation. But the third quantity n, which depends on the velocity, affects our expreſſions in ſuch a manner, that they muſt be calculated ſeparately for all the different values of n.

In order to unfold more fully the nature of this curve, it is neceſſary to conſider the radius or curvature, which meaſures its curvature at any point. Now, if $\dot{y} = \dot{p}\,x$, the radius of curvature is known to be $\frac{\dot{x}\,\overline{\times 1+p^2} \times \sqrt{\overline{1+p^2}}}{}$. Therefore, ſince $\frac{\dot{x}}{\dot{p}} = \frac{c}{n+P}$ for the deſcending branch, the radius of curvature at M will be $= \frac{c \times \overline{1+p^2} \times \sqrt{\overline{1+p^2}}}{n+P}$. And for the aſcending branch, where $\dot{y}$ is alſo $= p\,\dot{x}$, the radius of curvature at N will be $= \frac{c \times \overline{1+p^2} \times \sqrt{\overline{1+p^2}}}{n-P}$. Therefore, when $P = n$, and the velocity of the body infinitely great, the radius of curvature becomes infinitely great alſo; and it appears, that in theſe two branches, where the tangents are equally inclined to the horizon, the radius of curvature, and alſo the other quantities x, y, s, t, and v, are greater in the aſcending than in the deſcending branch.

Therefore, in a reſiſting medium, the two branches of the curve are diſſimilar, ſo that the curvature is greateſt in the deſcending branch, and the motion ſwifteſt in the aſcending branch. But when there is no reſiſtance, it is known that the two branches are equal and ſimilar, and alſo the motion the ſame in both; for, in vacuo, the quantity c becomes infinite, and ſo does the number n, ſince $\frac{ac}{2n}$ denotes the height anſwering to the velocity at A. Therefore P will be nothing in reſpect of n; and becauſe $a = 1$, if we put $\frac{c}{2n} = b$; we ſhall have for a non-reſiſting medium $x = 2bp$, $y = p^2$, $s = 2b \times$ fluent of $\dot{p}\sqrt{1+p^2}$; $t = 2bp$; $v = b \times \overline{1+p^2}$; and the radius of the curvature $= 2b \times \overline{1+p^2}^{\frac{3}{2}}$. Whence it is evident, that the curve is a parabola, and the motion ſuch as it is generally allowed to be.

It is, therefore, from the quantity $P =$ the fluent of $\dot{p}\sqrt{1+p^2}$, that the difference ariſes between a trajectory in vacuo, and in a fluid; and, it is evident, that this difference will be ſo much greater, the greater P is in reſpect to n. Now the quantity P vaniſhes at the vertex A; and from thence, P increaſes as the angle MTP, which the tangent of the curve makes with the horizon, increaſes; ſo that when this becomes a right angle, the quantity P becomes infinite; conſequently, how ſmall ſoever the reſiſtance be, the curve $CNAMH$ will at length deviate infinitely from a parabola; ſince, by continuing its branches, it muſt neceſſarily happen that the quantity P ſhall not only become equal to the number n, but at laſt infinitely exceed it.

PROVISIONS, in a *military ſenſe*, implies all manner of eatables, food, or provender, uſed in an army, both for man and beaſt.

PROVOST-*Marſhal*, of an army, is an officer appointed to ſecure deſerters, and all other criminals: he is often to go round the army, hinder the ſoldiers from pillaging, indict offenders, execute the ſentence pronounced, and regulate the weights and meaſures uſed in the army when in the field. He is attended by a lieutenant's guard, has a clerk, and an executioner.

PUNISHMENT, in the *army*, in general, ſignifies the execution of a ſentence pronounced by a court-martial upon any delinquent; but in particular it means that kind of puniſhment often uſed by inflicting a certain number of laſhes upon a non-commiſſioned officer, or private man.

PULLY, in *military mechanics*. See MECHANICS.

Q

QUADRANT, in *gunnery*, an inſtrument made of braſs or wood, divided into degrees, and each degree into 10 parts, to lay guns or mortars to any angle of elevation.

The common ſort is that whoſe radii projects the quadrant about 12 inches, and a plummet ſuſpends in its centre, by means of a fine thread of ſilk; ſo that, when the long end is introduced into the piece, the plummet ſhows its elevation.

The beſt ſort has a ſpiral level fixed to a braſs radius; ſo that, when the long end is introduced into the piece, this radius is turned about its centre 'till it is level; then its end ſhows the angle of elevation, or the inclination from the horizon; whereas the firſt ſhows that angle from the vertical. See LEVEL.

QUADRAT, or *to quadrat a gun*, is to ſee it duely placed in its carriage, and that the wheels be of an equal height.

QUARTER, in *war*, ſignifies the ſparing of men's lives, and giving good treatment to a vanquiſhed enemy. Hence, *to give quarter*, *to take quarter*, &c.

QUARTERS, at a *ſiege*, the encampment upon one of the moſt principal paſſages round a place beſieged, to prevent relief and convoys.

Head QUARTERS, *of an army*, the place where the commander in chief has his quarters. The quarters of generals of horſe are, if poſſible, in villages behind the right and left wings; and the generals of foot are often in the ſame place: but the commander in chief ſhould be near the centre of the army.

QUARTERS *of refreſhment*, the place or places where troops that have been much harraſſed are put to recover themſelves, during ſome part of the campaign.

QUARTER *of an aſſembly*, the place where the troops meet to march from in a body, and is the ſame as the place of rendezvous.

Intrenched QUARTERS, a place fortified with a ditch and parapet to ſecure a body of troops.

Winter QUARTERS, ſometimes means the ſpace of time included between leaving the camp and taking the field; but more properly, the places where the troops are quartered during the winter.

The firſt buſineſs, after the army is in *winter-quarters*, is to form the chain of troops to cover the quarters well: which is done either behind a river, under cover of a range of ſtrong poſts, or under the protection of fortified towns. Huſſars are very uſeful on this ſervice.

It ſhould be obſerved, as an invariable maxim, in *winter-quarters*, that your regiments be diſpoſed in brigades, to be always under the eye of a general officer; and, if poſſible, let the regiments be ſo diſtributed, as to be each under the command of its own chief.

QUARTER-*maſter*, is an officer, generally a lieutenant, whoſe principal buſineſs is to look after the quarters of the ſoldiers, their cloathing, bread, ammunition, firing, &c. Every regiment of foot, and artillery, has a quarter-maſter, and every troop of horſe one, who are only warrant-officers, except in the Blues.

QUARTER-*maſter-general*, is a conſiderable officer in the army, and ſhould be a man of great judgement and experience, and well ſkilled in geography: his duty is to mark the marches, and encampments of an army: he ſhould know the country perfectly well, with its rivers, plains, marſhes, woods, mountains, defiles, paſſages, &c. even to the ſmalleſt brook. Prior to a march he receives the orders and route from the commanding general, and appoints a place for the quarter-maſters of the army to meet him next morning, with whom he marches to the next camp, where being come, and having viewed the ground, he marks out to the regimental quarter-maſters the ground allowed each regiment for their camp: he chuſes the head quarters, and appoints the villages for the generals of the army's quarters: he appoints a proper place for the encampment of the train of artillery: he conducts foraging parties, as likewiſe the troops to cover them againſt aſſaults, and has a ſhare in regulating the winter quarters and cantonments.

QUARTER-*wheeling of a platoon, &c.* is turning the front where the flank was; which is done to the right, by the man on the right wing keeping his ground, and facing about while the left wing wheels. See WHEELING.

QUARTER-*ſtaff*, an old military weapon, is made of ſtrong and even wood, bigger and heavier than a pike: it is 6½ feet long between the verrils, that keep faſt the two pikes of iron ſtuck into the ends of the ſtaff.

QUARTER, in the *manage*, as to work from quarter to quarter, is to ride a horſe three times in upon the firſt of the four lines of a ſquare; then, changing your hand, to ride him three times upon the ſecond; and ſo to the third and fourth; always changing hands, and obſerving the ſame order.

QUARTERING *troops*, is to provide them with good quarters.

QUEUE D'ARONDE, in *fortification*, an outwork which is narrower at the gorge than at the front or face, being ſo called from its reſembling a ſwallow's tail. Of this kind are ſome ſingle or double tenailles, and even ſome horn-works whoſe ſides are not parallel. See SWALLOW'S TAIL, and FORTIFICATION.

QUICK-*match*, in *laboratory works*. See LABORATORY.

QUILTING *grape-ſhot*, in *gunnery*. See LABORATORY, and *To make* GRAPE-SHOT.

QUINTAL, the ſame as hundred weight.

QUOIL, in *gunnery*, denotes when a rope is laid round in a ring, one turn over another, for its being tranſported, or laid away.

QUOINS, in *gunnery*. See COINS.

R

RABINET, in *gunnery*, formerly a name given to a ſmall ſort of ordnance between a falconet and a baſe, about 1⅕ inches diameter in the bore, 5 feet 6 inches long, and 300 pounds in weight, loaded with 6 ounces of powder, carries a ſhot 1⅛ inches diameter. See CANNON.

RAFTERS, in *military buildings*, are pieces of timber, which, ſtanding by pairs on the reaſon or raiſing-piece, meet in an angle at the top, and form the roof of a building.

It is a rule in building, that no rafters ſhould ſtand farther than 12 inches from one another: and as to their ſizes or ſcantlings, it is provided by act of parliament, that principal rafters, from 12 feet 6 inches to 14 feet 6 inches long, be 5 inches broad at the top, and 8 at the bottom, and 6 inches thick: thoſe from 14 feet 6 inches, to 18 feet 6 inches long, to be 9 inches broad at the foot, 7 inches at the top, and 7 inches thick: and thoſe from 18 feet 6 inches, to 21 feet 6 inches, to be 10 inches broad at the foot, 8 at the top, and 8 thick. Single rafters, 8 feet in length, muſt have 4½ inches, and 3¾ in their ſquare. Thoſe of 9 feet long, muſt be 5, and 4 inches ſquare.

RAFTS, in a *military ſenſe*, a kind of frames or floats made by laying pieces of timber together, or acroſs each other, to ſerve as bridges for troops to paſs over rivers.

To RAISE *a* {*ſiege*. See SIEGE.
{*plan of a fortreſs*, is the meaſuring, with cords and geometrical inſtruments, the length of the lines, and the capacity of the

angles, that by knowing the length, breadth, and thickneſs, of all the different parts of a fortification, it may be repreſented in ſmall upon paper, ſo as to know the advantages and diſadvantages of it.

RALLYING, in *war*, re-eſtabliſhing, or forming together again, troops broken and put to flight.

Battering-RAM, in *antiquity*, a military engine uſed to batter and beat down the walls of places beſieged.

The battering-ram was of two ſorts, the one rude and plain, the other compound. The former ſeems to have been no more than a great beam, which the ſoldiers bore on their arms and ſhoulders, and with one end of it, by main force, aſſailed the walls. The compound ram is thus deſcribed by Joſephus: it is a vaſt beam, like the maſt of a ſhip, ſtrengthened at one end with a head of iron, ſomething reſembling that of a ram, whence it took its name. This was hung by the middle with ropes to another beam, which lay acroſs two poſts, and hanging thus equally balanced, it was by a great number of men drawn backwards and puſhed forwards, ſtriking the wall with its iron head.

Plutarch informs us, that Mark Anthony, in the Parthian war, made uſe of a ram 80 feet long: and Vitruvius tells us, that they were ſometimes 106, and ſometimes 120 feet long; and to this perhaps the force and ſtrength of the engine was in a great meaſure owing. The ram at one time was managed by a whole century of ſoldiers; and they, being ſpent, were ſeconded by another century; ſo that it played continually, without any intermiſſion.

The momentum of a battering-ram 28 inches in diameter, 180 feet long, with a head of caſt-iron of one tun and a half, the whole ram, with its iron hoops, &c. weighing 41,112 pounds, and moving by the united ſtrength of 1000 men, will be only equal to that of a ball of 36 pounds, when ſhot point-blank from a cannon.

RAMMER, an inſtrument uſed for driving down ſtones or piles into the ground in military works; or for beating the earth, in order to render it more ſolid for a foundation.

RAMMER *of a gun*, the ram-rod or gun-ſtick; a rod uſed in charging of a gun, to drive home the powder, as alſo the ſhot, and the wad, which keeps the ſhot from rolling out. The rammer of a piece of artillery, is a cylinder of wood, whoſe diameter and length are each equal to the diameter of the ſhot, with a handle fixed to it, at the end of which is another cylinder, covered with lamb-ſkin, ſo as to fit the gun exactly, and called a ſponge: it is uſed to clean the piece before and after it is fired.

RAMPART, in *fortification*, or, as ſome call it, but improperly, *rampire*; the great maſſy bank of earth raiſed about a place to reſiſt the enemy's great ſhot, and to cover the buildings. On it is raiſed a parapet towards the campain. It is not above 18 feet high, and about 60 or 70 thick, unleſs more earth be taken out of the ditch than can be otherwiſe beſtowed. The rampart ſhould be ſloped on both ſides, and be broad enough to allow the marching of waggons and cannon, beſides the parapet which is raiſed on it. The rampart of the half-moons is better for being low, that the ſmall-arms of the beſieged may the better reach the bottom of the ditch; but it muſt be ſo high, as not to be commanded by the covert-way. The rampart is encompaſſed with a ditch, and is ſometimes lined with a fauſſe-bray and a berme. During a ſiege, ſoldiers are always poſted on the rampart, and ſometimes artillery to ſtrengthen the defence.

RAMPS, in *fortification*, are ſloping communications, or ways of very gentle aſcent, leading from the inward area, or lower part of a work, to the rampart or higher part of it.

RAMS-*horns*, in *fortification*, are a kind of low works make in the ditch of a circular arc: they were invented by M. Belidor, and ſerve inſtead of tenailles.

RANDOM-*ſhot*, in *artillery*, when the piece is elevated at an angle of 45 degrees upon a level plane. See RANGE.

RANGE, in *gunnery*, the diſtance from the battery to the point where the ſhot or ſhell touches the ground.

Point-blank RANGE, that when the piece lies in a horizontal direction, and upon a level plane, without any elevation. See POINT-BLANK.

RANGING, in *war*, diſpoſing the troops in order proper for an engagement, for manœuvring, or for marching, &c.

RANK, is a ſtraight line made by the ſoldiers of a battalion, or ſquadron, drawn up ſide by ſide: this order was eſtabliſhed for the marches, and for regulating the different bodies of troops and officers which compoſe an army.

RANK, *and precedence in the army and navy*, as follows:

Engineers RANK. Chief, as colonel; director, as lieutenant-colonel; ſub-director, as major; engineer in ordinary, as captain; engineer extraordinary, as captain-lieutenant; ſub-engineer, as lieutenant; practitioner-engineer, as enſign.

Navy **Rank.** Admiral, or commander in chief of his Majeſty's fleet, has the rank of a field-marſhal; admirals, with their flags on the main-top-maſt-head, rank with generals of horſe and foot; vice-admirals, with lieutenant-generals; rear-admirals, as major-generals; commodores, with broad pendants, as brigadier-generals; captains of poſt-ſhips, after three years from the date of their firſt commiſſion, as colonel; other captains, as commanding poſt-ſhips, as lieutenant-colonels; captains, not taking poſt, as majors; lieutenants, as captains.

Rank *between the army, navy, and governors.*

Army	Navy	Governors
General in chief	Admiral in chief	Commander in chief of the forces in America
Generals of horſe	Admiral with a flag at the main-top-maſt	Captain-general of provinces
Lieutenant-generals	Vice-admirals	Lieutenant-generals of provinces
Major-generals	Rear-admirals	Lieutenant-governors and preſidents
Colonels	Poſt-captains of 3 years	Lieutenant-governors not commanding
Lieutenant-colonels	Poſt-captains	Governors of charter colonies
Majors	Captains	Deputy governors
Captains	Lieutenants	Eſtabliſhed by the king, 1760

Doubling of the Ranks, is the placing two ranks in one, frequently uſed in the manœuvres of a regiment.

Ranks *and files,* are the horizontal and vertical lines of ſoldiers when drawn up for ſervice, &c.

RANSOM, in *military hiſtory,* a ſum of money paid for the liberty of a priſoner of war; it alſo means the exchange of priſoners of war.

RAPIER, formerly ſignified a long, old-faſhioned broad-ſword, ſuch as thoſe worn by the Scotch regiments; but now is underſtood only to mean a ſmall ſword, as contradiſtinguiſhed from a back-ſword.

RASANT, RAZANT, in *fortification,* raſant flank, or line, is that part of the curtain or flank whence the ſhot exploded raſe or glance along the ſurface of the oppoſite baſtion.

RATION, in the *army,* a day's allowance of bread, or of forage, given to every man and horſe. A ration of bread is 1½ pound each day; and for a horſe 20lb. of hay, 10lb. of oats, and 5lb. of ſtraw, and for want of ſtraw, 25lb. of hay. The officers have ſeveral rations, according to their rank. In the laſt German war, eſpecially towards the latter end of it, a ration for a horſe was only 18lb. of hay, 6lb. of oats, and 5lb. of ſtraw.

It is to be obſerved, that the troops in North-America are daily ſupplied with ſhips proviſions (independent of their pay) from his majeſty's ſtores: a ſoldier's allowance per week is 7lb. of beef, or in lieu thereof 4lb. of pork; 7lb. of biſcuit bread, or the ſame weight of flour; 6 oz. of butter; 3 pints of peaſe; ½lb. of rice: and this is called 7 rations. Of theſe rations a general had 12, colonel 6, lieutenant-colonel 5, major 4, captain 3, ſubaltern 2, ſtaff 2, chief engineer 5, engineer in ordinary 3, practitioner engineer 2, director of the hoſpital 5, head ſurgeon 3, ſurgeon's mate 1, head apothecary 3, his mate 1, commiſſary of ſtores 3, his clerk 2.

RAVELINS, in *fortification,* are works raiſed on the counterſcarp before the curtain of the place, and ſerve to cover the gates of a town, and the bridges. They conſiſt of two faces, forming a ſaliant angle, and are defended by the faces of the neighbouring baſtions. They are the moſt in uſe of all out-works, and are by the ſoldiers moſt commonly called half-moons. They ſhould be lower than the works of the place, that they may be under the *fire* of the beſieged. Their parapets, as thoſe of all out-works, ſhould be cannon-proof; that is, about 18 feet thick.

RAVINE, in *field fortification*, a deep hollow, uſually formed by a great flood, or long-continued running of water; frequently turned to good purpoſes in the field.

REAR *of an army*, ſignifies, in general, the hindermoſt part of an army, battalion, regiment, or ſquadron; alſo the ground behind either.

Rear-*guard*, is that body of an army which marches after the main-body; for the march of an army is always compoſed of an advance-guard, a main-body, and a rear-guard; the firſt and laſt commanded by a general. The old grand-guards of the camp, always form the rear-guard of the army, and are to ſee that every thing come ſafe to the new camp. See Guard.

Rear-*half-files*, are the three hindmoſt ranks of the battalion, when it is drawn up ſix deep.

Rear-*line*, of an army encamped, is always 1200 feet at leaſt from the centre line; both of which run parallel to the front line, as alſo to the reſerve.

Rear-*rank*, is the laſt rank of a battalion, when drawn up, and generally 16 or 18 feet from the centre-line, when drawn up in open order.

REBELLION, a traiterous taking-up of arms againſt the king by his own natural ſubjects, or thoſe formerly ſubdued.

RECOIL, in *gunnery*, is the running-back of the artillery when fired; which is occaſioned by the ſtruggling of the powder in the chamber, and its ſeeking every way to fly out. Guns, whoſe vents are a little forward in the chaſe, recoil moſt. To leſſen the recoil of a gun the platforms are generally made ſloping towards the embraſures of the battery.

RECONNOITRE, in *military affairs*, implies to view and examine the ſtate of things, in order to make a report thereof.

Parties ordered to reconnoitre, are to obſerve the country and the enemy; to remark the routes, conveniences and inconveniences of the firſt; the poſition, march, or forces of the ſecond. In either caſe, they ſhould have an expert geographer, capable of taking plans readily: he ſhould be the beſt mounted of the whole, in caſe the enemy happen to ſcatter the eſcorte, that he may ſave his works and ideas.

All parties that go for reconnoitring only, ſhould be but few in number. I would never chuſe more than twelve or twenty men. An officer, be his rank what it will, cannot decline going with ſo few under his command: the honour is amply made up by the importance of the expedition, frequently of the moſt intereſting conſequence, and the propereſt to recommend the prudence, bravery, and addreſs of any officer that has the fortune to ſucceed.

It is previouſly neceſſary that the officer ordered on this duty ſhould be well accquainted with the country, the roads, and the diſtance of the enemy. His party muſt conſiſt of men of approved fidelity, part of whom ſhould be diſguiſed. This detachment muſt march off in the night. The men muſt have ſtrict orders neither to ſmoke tobacco, make a noiſe, nor ſpeak. The officer muſt be provided with two guides, who are to be ſtrictly interrogated, but are to remain ignorant of the route you intend to take. A detachment of this kind ſhould be furniſhed with ſubſiſtence for 2 or 3 days. The horſes are to be fed every 2 or 3 leagues, for it is abſolutely neceſſary that they ſhould be always freſh and fit for duty. The officer will take care never to halt, but at a diſtance from any road, and alſo take every precaution to prevent his being ſurpriſed, whilſt his horſes are feeding, &c.

RECRUITS, in *military affairs*, are new men raiſed to ſupply the places of ſuch as have loſt their lives in the ſervice.

Recruit-*horſes*, are the horſes brought up for completing the regiments of horſe and dragoons.

RECTANGLE. See Angle.

REDANS, in *field fortification*, are a kind of indented works, lines, or faces, forming ſallying and re-entering angles, flanking one another; generally uſed on the ſides of a river which runs through a garriſon-town. They were uſed before baſtions were invented, and are by ſome thought preferable to them.

REDENS, } See Redans.
REDENT, }

REDOUT, in *fortification*, a ſquare work of ſtone, raiſed without the glacis of the place, about muſket-ſhot from the town; having loop-holes for the ſmall arms to fire through, and ſurrounded by a ditch. Sometimes they are of earth, having only a defence in front, ſurrounded by a parapet and ditch. Both the one and the other ſerve for detached guards to interrupt the enemy's works; and are ſometimes made on the angles of the trenches for covering the workmen againſt the ſallies of the garriſon. The length of their ſides may be about 12 or 20 toiſes: their parapets muſt have 2 or 3 banquettes, and be about 9 or 10 feet thick. They are ſometimes (in a ſiege) called places of arms.

Redout, is alſo the name of a ſmall work made in a ravelin, of various forms. See Fortification.

Redout, *caſtle* or *donjon*, a place more particularly intrenched, and ſeparated from the reſt by a ditch. There is generally in each of them a high tower, from whence the country round the place may be diſcovered.

Detached Redout, is a work made at ſome diſtance from the covert-way, much in the ſame manner as a ravelin with flanks. See Arrow.

Redouts *en cremaillere*, differ from all the reſt, becauſe the inſide line of the parapet is broken in ſuch a manner as to reſemble a pot-hook, or teeth of a ſaw; whereby this advantage is gained, that a greater fire can be brought to bear upon the defilé, than if only a ſimple face was oppoſed to it, and conſequently the paſſage is rendered more difficult. See Pl. XV. *fig.* 2.

REDOUBT, }
REDUCT, } See Redout.

REDUCE *a place*, is to oblige the governor to ſurrender it to the beſiegers, by a capitulation.

RE-ENTERING *angle*, in *fortification*, is that which turns its point towards the centre of the place. See Fortification.

REFORM, in a *military ſenſe*, is to reduce a corps of men, by either diſbanding the whole, or only breaking a part, and retaining the reſt; or ſometimes by incorporating them with other regiments.

REFORMED-*officer*, is one whoſe troop or company is broke, and he continued in whole or half-pay, ſometimes doing duty in the regiment: he preſerves the right of ſeniority, and continues in the way of preferment.

REGIMENT, is a body of men, either horſe, foot, or artillery, commanded by a colonel, lieutenant-colonel, and major: each regiment of foot is divided into companies, but the number of companies differ; though in England our regiments are generally 10 companies, one of which is always grenadiers, excluſive of the two independent companies. Regiments of horſe are commonly 6 troops, but ſome of 9. Dragoon regiments, are generally in war-time 8 troops, and in time of peace but 6. Each regiment has a chaplain, quarter-maſter, adjutant, and ſurgeon. Some German regiments conſiſt in 2000 foot, and the regiment of Picardy, in France, in 6000, being 120 companies, of 50 men in each company.

Regiments were firſt formed in France in the year 1558, and in England in the year 1660.

REGIMENTAL-*ſtaff*. See Staff.

REGIMENTALS, is the uniform cloathing of the army; and conſiſts in a hat, coat, waiſtcoat, breeches, ſhirts, ſtocks, ſhoes, ſtockings, ſpats, ſpatterdaſhes, &c. See Neceſſaries.

REGULAR *attacks*, in a *ſiege*, are ſuch as are made in form; that is, by regular approaches. See Attacks.

REINFORCE, in *founding guns*, that part of a gun next to the breech, which is made ſtronger to reſiſt the force of the powder. There are generally two in each piece, called the firſt and ſecond reinforce: the ſecond is ſomething ſmaller than the firſt, upon the ſuppoſition that when the powder is inflamed, and occupies a greater ſpace, its force is diminiſhed, which is a very great abſurdity. See Cannon.

Reinforce-*ring*. There are three in each gun, called the firſt, ſecond, and third: they are flat mouldings, like flat iron hoops, placed at the breech end of the firſt and ſecond reinforce, projecting the reſt of the metal by about ¼ of an inch.

REINFORCEMENT *to the army*, is an addition of freſh troops to ſtrengthen an army, in order to enable them to go on with an enterpriſe, &c.

REJOICING-*fire*, in *military affairs*, is uſed on obtaining a victory, or on celebrating ſome public feſtival. There are, however, two ſorts of rejoicing fires; the one by a volley, and the other by a running fire from right to left of the battalion or line. When a volley is to be fired, the battalion or line is to fire together, either by a ſignal, or by word of command. But ſhould a running fire be made, it is to be performed from right to left in the ſucceſſion of files; that is, the men of the firſt file on the right of the battalion are, on the word of command, *Begin*, to pull their triggers; and then, as ſoon as thoſe of the ſecond file obſerve the flaſh in the pans of the firſt, they are alſo to pull their triggers; and ſo on from one file to another, 'till the fire ends with the left hand file of the battalion or line.

RELAIS. See Berm, and Foreland.

RELAY-*horſes*, in the *artillery*, are ſpare horſes that march with the artillery and baggage, ready to relieve others, or to aſſiſt in getting up a hill, or through bad roads, &c.

RELIEVE *the guard*, is to put freſh men upon guard, which is generally every 24 hours.

To RELIEVE *the trenches*, is to relieve the guard of the trenches, by appointing thoſe for that duty, who have been there before.

To RELIEVE *the ſentries*, is to put freſh men upon that duty from the guard, which is generally done every two hours, by a corporal who attends the relief, to ſee the proper orders are delivered to the ſoldier who relieves.

RELIEVER, an iron ring fixed to a handle by means of a ſocket, ſo as to be at right angles to it: it ſerves to diſengage the ſearcher of a gun, when one of its points is retained in a hole, and cannot be got out otherwiſe. See SEARCHER.

REMOUNT. To remount the cavalry or dragoons, is to furniſh them with horſes in the room of thoſe which have been either killed or diſabled.

RENCOUNTER, in the *military art*, an engagement of two little bodies or parties, detached from the army; in which ſenſe it ſtands in oppoſition to a pitched battle.

RENDEZVOUS, } in a *military ſenſe*, the
RENDEVOUS, } place appointed by the general, where all the troops that compoſe the army are to meet at the time appointed, in caſe of an alarm. This place ſhould be fixed upon, according to the ſituation of the ground, and the ſort of troops quartered in the village. In an open country it is eaſy to fix upon a place of rendezvous, becauſe the general has whatever ground he thinks neceſſary. In towns and villages the largeſt ſtreets, or market-places, are very fit: but let the place be where it will, the troops muſt aſſemble with eaſe, and proceed to the charge.

REPORTS, in *military matters*, are daily, weekly, and monthly reports, of the ſtate of the companies or regiments, relative to their being abſent, preſent, on duty, ſick, confined, &c.

REPRISALS, a right which princes claim of taking from their enemies any thing equivalent to what they unjuſtly detain from them.

RESERVE, a body of troops ſometimes drawn out of the army, and encamped by themſelves, in a line behind the lines.

RESERVE-*guard*, the ſame as a picquet-guard, except that the one mounts at troop-beating, and the other at retreat-beating.

Body of RESERVE, } in *military affairs*, the
Corps of RESERVE, } third or laſt line of an army, drawn up in battle; ſo called, becauſe they are reſerved to ſuſtain the reſt, as occaſion requires; and not to engage but in caſe of neceſſity.

RETIRADE, in *field fortification*, a trench with a parapet; but *retirade* and *coupture*, are commonly taken for a retrenchment formed by the two faces of the re-entering angle in a body of a place, after the firſt defence is ruined, and the beſieged obliged to abandon the head of the work without quitting it entirely; therefore, while ſome are making head againſt the enemy, others ſhould be buſy in making the retirade; which is ſometimes a ſimple barricade, or retrenchment, thrown up in haſte, with a ſort of ditch before it.

The *retirade* ſhould be raiſed as high as poſſible, and ſome fougaſſes made under it, to blow up the enemy's lodgements.

RETREAT, in a *military ſenſe*. An army or body of men are ſaid to retreat when they turn their backs upon the enemy, or are retiring from the ground they occupied: hence, every march in withdrawing from the enemy is called a retreat.

That which is done in ſight of an active enemy, who purſues with a ſuperior force, makes my preſent ſubject; and is, with reaſon, looked upon as the glory of the profeſſion. It is a manœuvre the moſt delicate, and the propereſt to diſplay the prudence, genius, courage, and addreſs, of an officer who commands: the hiſtories of all ages teſtify it, and hiſtorians have never been ſo laviſh of eulogiums as on the ſubject of the brilliant retreats of our heroes. If it is important, it is no leſs difficult to regulate, on account of the variety of circumſtances, each of which demands different principles, and an almoſt endleſs detail. Hence a good retreat is eſteemed, by experienced officers, the maſter-piece of a general. He ſhould therefore be well acquainted with the ſituation of the country through which he intends to make it, and careful that nothing is omitted to make it ſafe and honourable.

RETREAT, is alſo a beat of the drum, at the firing of the evening-gun; at which the drum-major, with all the drums of the battalion, except ſuch as are upon duty, beats from the camp-colours on the right to thoſe on the left, on the parade of encampment: the drums of all the guards beat alſo; the trumpets at the ſame time ſounding at the head of their reſpective troops. This is to warn the ſoldiers to forbear firing, and the ſentinels to challenge 'till the break of day, that the reveille is beat. The retreat is likewiſe called ſetting the watch.

RETRENCHMENT, in the *art of war*, is any work raiſed to cover a poſt, and fortify it againſt an enemy; ſuch as faſcines loaded with earth, gabions, barrels, &c. filled with earth, ſand-bags, and generally all things that can cover the men, and ſtop the enemy: but it is more applicable to a ditch bordered with a parapet; and a poſt thus fortified, is called a *retrenched poſt*, or *ſtrong poſt*. *Retrenchments* are either general, or particular.

General RETRENCHMENTS, are a kind of new fortifications made in a place beſieged, to cover the defendents, when the enemy become maſters of a lodgement on the fortification, that they may be in a condition of diſputing the ground inch by inch, and of putting a ſtop to the enemy's progreſs in expectation of relief: as, if the beſiegers attack a tenaille of the place, which they judge the weakeſt, either by its being ill flanked, or commanded by ſome neighbouring ground; then the beſieged make a great *retrenchment*, incloſing all that part which they judge in moſt danger. Theſe ſhould be fortified with baſtions and demi-baſtions, ſurrounded by a good ditch countermined, and higher than the works of the place, that they may command the old works, and put the beſiegers to infinite trouble in covering themſelves.

Particular RETRENCHMENTS, ſuch as are made in the baſtions, when the enemy are maſters of the breach. They can never be made but in full baſtions; for in empty and hollow ones, *retirades* only can be formed. Theſe particular *retrenchments* are ſometimes made at firſt, which certainly is beſt. Count Pagan always made a double parapet in all his baſtions; and a *retrenchment* made before-hand requires no more men for its defence, than if it were not made; becauſe they never defend it 'till the principal work is loſt. The parapet of ſuch *retrenchment* ſhould be 6 or 8 feet thick, and 5 feet high, with a large and deep ditch, from whence ſhould run out ſmall *fougaſſes*; and alſo be countermined.

RETURNS, in a *military ſenſe*, are of various ſorts, but all tending to explain the ſtate of the army, regiment, or company; namely, how many capable of doing duty, on duty, ſick in quarters, barracks, infirmary, or hoſpital; priſoners, abſent with or without leave; total effective; wanting to complete to the eſtabliſhment, &c.

RETURNS *of a mine*, are the turnings and windings of the gallery leading to the mine. See GALLERY.

RETURNS *of a trench*, the various turnings and windings which form the lines of the trench, and are, as near as they can be, made parallel to the place attacked, to ſhun being enfiladed. Theſe *returns*, when followed, make a long way from the end of the trench to the head, which going the ſtraight way is very ſhort: but then the men are expoſed; yet, upon a ſally, the courageous never conſider the danger, but getting over the trench with ſuch as will follow them, take the ſhorteſt way to repulſe the enemy, and cut off their retreat, if poſſible.

REVEILLE, is the beat of a drum, about break of day, to advertiſe the army that it is day-light, and that the ſentinels forbear challenging.

REVERSE, in a *military ſenſe*, ſignifies *on the back*, or *behind*: ſo we ſay, *a reverſe commanding ground*, a *reverſe battery*, &c.

REVETEMENT, in *fortification*, a ſtrong wall, built on the outſide of the rampart and parapet, to ſupport the earth, and prevent its rolling into the ditch.

When the *revêtement* of a rampart goes quite up to the top, 4 feet of the upper part is a vertical wall of 3 feet thick, with a ſquare ſtone at the top of it, projecting 6 inches, and a circular one below, or where the ſlope begins, of 8 or 10 inches diameter: they go quite round the rampart, and this circular projection is called the *cordon*.

REVIEW, is the drawing out all, or part of the army in line of battle, to be viewed by the king, or a general, that they may know the condition of the troops.

At all *reviews*, the officers ſhould be properly armed, ready in their exerciſe, ſalute well, in good time, and with a good air; their uniform genteel, &c. The men ſhould be clean and well dreſſed; their accoutrements well put on; very well ſized in their ranks; the ſerjeants expert in their duty, drummers perfect in their beatings, and the fifers play correct. The manual exerciſe muſt be performed in good time, and with life; and the men carry their arms well; march, wheel, and form with exactneſs. All manœuvres muſt be performed with the utmoſt regularity, both in quick and ſlow time. The firings are generally 36 rounds; viz. by companies; by grand diviſions; by ſub-diviſions; obliquely, advancing, retreating; by files; in the ſquare; ſtreet firings, advancing and retreating; and laſtly, a volley. The intention of a *review* is, to know the condition of the troops, to ſee that they are complete, and perform their exerciſe and evolutions well.

RHINELAND *rod*, is a meaſure of 12 feet, uſed by all the Dutch engineers.

RICOCHET, in *gunnery*, is when guns, howitzers or mortars, are loaded with ſmall charges, and elevated from 5 to 12 degrees, ſo as to fire over the parapet, and the ſhot or ſhell rolls along the oppoſite rampart: it is called *ricochet-firing*, and the batteries are likewiſe called *ricochet-batteries*. This method of firing was firſt invented by M. [redacted] and firſt uſed at the ſiege of Ath, in 1697. This method of firing out of mortars, was firſt tried in 1723, at the military ſchool at Straſbourg, and with ſucceſs. At the battle of Roſbach, in 1757, the king of Pruſſia had ſeveral 6-inch mortars made with trunnions, and mounted on travelling-carriages, which fired obliquely on the enemy's lines, and amongſt their horſe, loaded with 8 ounces of powder, and at an elevation of 1 degree 15 minutes, which did great execution; for the ſhells rolling along the lines, with burning fuzes, made the ſtouteſt of the enemy not wait for their burſting.

RIDEAU, in *military affairs*, is a riſing ground, or eminence, commanding a plain, ſometimes almoſt parallel to the works of a place: it is a great diſadvantage to have rideaus near a fortification, eſpecially when the enemy fire from far, and terminate on the counterſcarp: they not only command the place, but facilitate the enemy's approaches.

RIDER, in *artillery carriages*, a piece of wood ſomewhat higher than broad, the length equal to that of the body of the axle-tree, upon which the ſide-pieces reſt in a four-wheel carriage, ſuch as the ammunition-waggon, block-carriage, and ſling-waggons.

RINGS, in *artillery*, are of various uſes; ſuch as the laſhing-rings in travelling-carriages, to laſh the ſponge, rammer, and ladle, as well as the tarpauling that covers the guns; the rings faſtened to the breeching-bolts in ſhip-carriages; and the ſhaft-rings to faſten the harneſs of the ſhaft-horſe by means of a pin.

RIVETING-*plates*, in *gun-carriages*, ſmall ſquare thin pieces of iron, through which the ends of the bolts paſs, and riveted upon them.

ROCKETS. See Laboratory.

RODS, or *rammers*, either of iron or wood, to drive home the charges of muſkets, carabines, and piſtols.

Rods, or *ſticks*, faſtened to ſky-rockets, to make them riſe in a ſtraight line.

ROLL-*calling*, in *military matters*, is the calling over of a troop or company by their names, to ſee they are all preſent.

Muſter-Roll, is a return, which each captain gives the muſter-maſter, on which are written the names of both officers and ſoldiers of his company.

To Roll *in duty*, is when officers of the ſame rank take their turns upon duty, as captains with captains, ſubalterns with ſubalterns, and command according to the ſeniority of their commiſſions.

ROLLERS, are round pieces of wood of about 9 inches diameter, and 4 feet long, uſed in moving pieces of artillery from one place to another.

RONDEL, in *fortification*, a round tower, ſometimes erected at the foot of a baſtion.

ROPES, of various lengths and thickneſs, according to the uſes they are made for; ſuch as drays for the gin, for the ſling-cart and waggon, &c.

Drag-Ropes, in the *artillery*, by which the ſoldiers pull the guns backwards or forwards, both at practice and in an engagement, are of the following dimenſions, viz. For a 24-pounder, 54 feet long, with the loop-holes for the pegs included, and 5¾ inches in circumference; for 18 and 12-pounders, 48 feet long, and 4 inches in circumference; for 6 and 3-pounders, 39 feet long, and 1⅞ inches in circumference. For 13 and 10-inch howitzers, 45 feet long, and 6¾ inches in circumference; for 8-inch howitzers, 48 feet long, and 4 inches in circumference; for all other howitzers, 35 feet long, and 2 inches in circumference.

ROSTER, in *military affairs*, is a plan or table, by which the duty of officers, entire battalions, and ſquadrons, is regulated.

ROUNDS, in *military matters*, a detachment from the main-guard, of an officer or a non-commiſſioned officer and 6 men, who go round the rampart of a garriſon, to liſten if any thing be ſtirring without the place, and to ſee that the ſentinels be diligent upon their duty, and all in order. In ſtrict garriſons the rounds go every half-hour. The ſentinels are to challenge at a diſtance, and to reſt their arms as the *round* paſſes. All guards turn out, challenge, exchange the parole, and reſt their arms, &c.

Rounds, are ordinary, and extraordinary. The ordinary rounds are three; the *town-major's round*, the *grand round*, and the *viſiting round*.

Manner of going the Rounds. When the town-major goes his *round*, he comes to the main-guard, and demands a ſerjeant and 4 or 6 men to eſcort him to the next guard; and when it is dark, one of the men is to carry a light.

As ſoon as the ſentry at the guard perceives the *round* coming, he ſhall give notice to the guard, that they may be ready to turn out when ordered; and when the *round* is advanced within about 20 or 30 paces of the guard, he is to challenge briſkly; and when he his anſwered by the ſerjeant who attends the round, *Town-major's round*, he is to ſay, *Stand, round!* and reſt his arms: after which he is to call out immediately, *Serjeant, turn out the guard! town-major's round.* Upon the ſentry calling, the ſerjeant is to turn out the guard immediately, drawing up the men in good order with ſhouldered arms, the officer placing himſelf at the head of it, with his arms in his hand. He then orders the ſerjeant and 4 or 6 men to advance towards the *round*, and challenge: the ſerjeant of the *round* is to anſwer, *Town-major's round*; upon which the ſerjeant of the guard replies, *Advance, ſerjeant, with the parole!* at the ſame time ordering his men to reſt their arms. The ſerjeant of the *round* advances alone, and gives the ſerjeant of the guard the parole in his ear, that none elſe may hear it; during which period, the ſerjeant of the guard holds the ſpear of his halbert at the other's breaſt. The ſerjeant of the *round* then returns to his poſt, whilſt the ſerjeant of the guard, leaving his men to keep the *round* from advancing, gives the parole to his officer. This being found right, the officer orders his ſerjeant to return to his men; ſays, *Advance, town-major's round!* and orders the guard to reſt their arms; upon which the ſerjeant of the guard orders his men to wheel back from the centre, and form a lane, through which the town-major is to paſs (the eſcort remaining where they were) and go up to the officer and give him the parole, laying his mouth to his ear. The officer holds the ſpear of his eſponton at the town-major's breaſt while he gives him the parole.

The deſign of *rounds* is not only to viſit the guards, and keep the ſentinels alert, but likewiſe to diſcover what paſſes in the outworks, and beyond them.

ROUTE, in *military matters*, an order to direct troops to march the road they are to take, and an authority to the magiſtrates to provide quarters for them.

ROYALS, in *artillery*, are a kind of ſmall mortars, which carry a ſhell whoſe diameter is 5.5 inches. They are mounted on beds the ſame as other mortars. See *Dimenſions of braſs land-mortars*, at the word MORTAR.

ROYAL *academy*. See ACADEMY.

ROYAL *army*, an army marching with heavy cannon, capable of beſieging a ſtrong fortification, &c.

ROYAL *parapet*, in *fortification*, a bank about 3 toiſes broad, and 6 feet high, placed upon the brink of the rampart, towards the enemy: its uſe is to cover thoſe who defend the rampart.

RUFFLE, RUFF, } a beat on the drum. Lieutenant generals have 3 ruffles, major generals 2, brigadiers 1, and governors 1, as they paſs by the regiment, guard, &c. See DRUM.

To RUN *the gantlope*, is a puniſhment for conſiderable offences. When a ſoldier is ſentenced to run the gantlope, the regiment is drawn out in two ranks facing each other: each ſoldier, having a ſwitch in his hand, laſhes the criminal as he runs along naked from the waiſt upwards. While he runs, the drums beat at each end of the ranks. Sometimes he runs 3, 5, or 7 times, according to the nature of the offence. The major is on horſeback, and takes care that each ſoldier does his duty

RUNNING-*fire*. See FIRE.

S

SABRE, in *military hiſtory*, a kind of ſword, or ſcimetar, with a very broad and heavy blade, thick at the back, and a little falcated, or crooked towards the point.

SAC *à terre*. See BAGS.

SACKS. See BAGS.

SAFE-*guard*, in *military affairs*, a protection granted by a prince or general, for ſome of the enemy's lands, houſes, perſons, &c. to preſerve them from being inſulted or plundered. See GUARD.

SAKER, an old word for *cannon*. It carried a ſhot of 5 pounds and a quarter weight: the diameter of the bore was 3 inches and 9-16ths; the length 8 or 9 feet. See CANNON.

SALIENT *angle*, in *fortification*, that whoſe points turn from the centre of the place. See FORTIFICATION.

SALLY, in a *ſiege*, when a party of the garriſon goes out privately, and falls ſuddenly on the beſiegers in their trenches, endeavouring to drive them out, and deſtroy their works.

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If the garriſon is weak, ſallies are ſeldom made; though they fatigue an enemy, obſtruct their works, &c. Prudence is the beſt guide: they ſhould be always bold, daring, ſecret, and, at various times, equally concerted for the attack as for the defence.

SALTING-*boxes*, in *artillery*, are boxes of about 4 inches high, and 2½ in diameter, for holding mealed powder, to ſprinkle the fuzes of ſhells, that they may take fire from the blaſt of the powder in the chamber; but it has been found that the fuze takes fire without this operation with mealed powder, which renders theſe *boxes* almoſt uſeleſs.

SALTPETRE, the principal ingredient for making gun-powder; it is found in great plenty in ſome of the Eaſt-India provinces, and in ſome parts of Europe. See GUN-POWDER.

SALUTE, in *military matters*, a diſcharge of artillery, or ſmall arms, or both, in honour of ſome perſon of extraordinary quality. The colours likewiſe ſalute royal perſons, and generals commanding in chief; which is done by lowering the point to the ground. In the field, when a regiment is to be reviewed by the king, or his general, the drums beat a march as he paſſes along the line, and the officers ſalute one after another, bowing their half-pikes or ſwords to the ground; then recover, and take off their hats. The enſigns ſalute all together, by lowering their colours.

SAND, in *military architecture*. The beſt ſand for good mortar, is that whoſe grain is not too ſmall, and muſt be clear of the earthy particles. Sand found in rivers is eſteemed the beſt, as having a coarſe grain, and being free from earth and mud. See MORTAR.

SAND-*bags*, in *military affairs*. See BAGS.

SAP, in *ſieges*, is a trench, or an approach made under cover of 10 or 12 feet broad, when the beſiegers come near the place, and the fire from the garriſon grows ſo dangerous, that they are not able to approach uncovered.

There are ſeveral ſorts of *ſaps*; the ſingle, which has only a ſingle parapet; the double, having one on each ſide; and the flying, made with gabions, &c. In all *ſaps*, traverſes are left to cover the men.

SAPPERS, are ſoldiers belonging to the royal artillery, whoſe buſineſs it is to work at the ſaps, and for which they have an extraordinary pay. A brigade of *ſappers* generally conſiſts of 8 men, divided equally into two parties; and whilſt one of theſe parties is advancing the ſap, the other is furniſhing the gabions, faſcines, and other neceſſary implements, who relieve each other alternately.

SARRAZINE. See PORTCULLIS, and HERSE.

SASHES, are badges of diſtinction, worn by the officers, either round the waiſt, or over the ſhoulder. They are made of crimſon ſilk.

SAUCISSE, } in *mining*, is a long pipe or
SAUCISSON, } bag, made of cloth well pitched, or ſometimes of leather, of about 1½ inch diameter, filled with powder, going from the chamber of the mine to the entrance of the gallery. It is generally placed in a wooden pipe, called an *auget*, to prevent its growing damp. It ſerves to give fire to mines, caſſions, and bomb-cheſts, &c.

SAUCISSON, is likewiſe a kind of faſcine, longer than the common ones: they ſerve to raiſe batteries, and to repair breaches. They are alſo uſed in making epaulements, in ſtopping paſſages, and in making traverſes over a wet ditch, &c.

SCALADE, in *military affairs*, a furious attack upon a wall or rampart, contrary to form, and with no precaution; frequently carried on with ladders, to inſult the wall by open force.

SCALE, in a *military ſenſe*, a right line divided into equal parts, repreſenting miles, fathoms, paces, feet, inches, &c. uſed in making plans upon paper; giving each line its true length, &c.

SCALING-*ladders*. See LADDERS.

SCALPING, in *military hiſtory*, a barbarous cuſtom, in practice amongſt the Indian warriors, of taking off the tops of the ſcalps of the enemies ſculls with their hair on. They preſerve them as trophies of their victories, and are rewarded by their chiefs, according to the number they bring in.

SCARP, in *fortification*, is the interior talus or ſlope of the ditch next the place, at the foot of the rampart.

SCENOGRAPHY, which is alſo called *profile* or *view*, is the natural repreſentation of a place, ſuch as it appears to us, when we look upon it from without, conſidering its ſituation, the form of its walls, the number and figure of its ſteeples, and the tops of its public and private buildings.

SCONCE, in *fortification*, a kind of ſmall field-fort, built for the defence of ſome paſs, or other poſt.

SCOUR, or *to ſcour a line*, is to flank it, ſo as to ſee directly along it, that a muſket-ball, entering at one end, may fly to the other, leaving no place of ſecurity.

SCOUTS, in a *military ſenſe*, are generally horſemen ſent out before, and on the wings of an army, at the diſtance of a mile or two, to diſcover the enemy, and give the general an account of what they ſee.

SCREWS, in *gunnery*, are faſtened to the caſcable of light guns and howitzers, by means of an iron bolt, which goes through a ſocket fixed upon the centre tranſom, to lay the piece with, inſtead of wedges; as is done in heavy pieces.

SEA-*mortars*. See MORTARS.

SECOND *covert-way*, that beyond the ſecond ditch. See FORTIFICATION.

SECOND *ditch*, that made on the outſide of the glacis, when the ground is low, and water plenty. See FORTIFICATION.

SECOND *captain*. See CAPTAIN.

SECOND *lieutenant*. See LIEUTENANT.

SECTION, in *fortification*, is the ſame with its profile; or a delineation of its heights and depths raiſed on a plane, as if the works were cut aſunder to diſcover its inſide.

SENIORITY, in *military matters*, is the difference of time betwixt the raiſing of two regiments, whereby the one is ſaid to be ſo much ſenior to the other. All regiments take place according to ſeniority. The difference of time betwixt the dates of two commiſſions, makes the one ſenior to the other; and all officers of the ſame rank, roll by the ſeniority of their commiſſions.

SENTINEL, } is a private ſoldier, placed in
SENTRY, } ſome poſt, to watch the approach of the enemy, to prevent ſurpriſes, to ſtop ſuch as would paſs without order, or diſcovering who they are. They are placed before the arms of all guards, at the tents and doors of general officers, colonels of regiments, &c.

SENTINEL *perdu*, a ſoldier poſted near an enemy, in ſome very dangerous poſt, where he is in hazard of being loſt.

SERGEANT, } in *war*, is a non-commiſ-
SERJEANT, } ſioned or inferior officer in a company of foot, or troop of dragoons, armed with a halberd, and appointed to ſee diſcipline obſerved; to teach the private men their exerciſe; and to order, ſtraiten, and form ranks, files, &c. He receives the orders from the adjutant, which he communicates to his officers. Each company has generally two ſerjeants.

SERJEANT-*major*. See MAJOR.

SETTERS, in *gunnery*, a round ſtick to drive fuzes, or any other compoſitions, into caſes made of paper.

SHAFT-*rings*. See RINGS.

SHAFTS *of a carriage*, are two poles joined together with croſs-bars, whereby the hind horſe guides the carriage, and ſuports the fore part of the ſhafts, the hind part turning round an iron bolt.

SHAFT-*bars*, are two pieces of wood to faſten the hind ends of the ſhafts together, into which they are pinned with wooden pins.

SHELLS, in *gunnery*, are hollow iron balls to throw out of mortars or howitzers, with a fuze-hole of about an inch diameter, to load them with powder, and to receive the fuze: the bottom, or part oppoſite the fuze, is made heavier than the reſt, that the fuze may fall uppermoſt; but in ſmall elevations it is not always the caſe, nor is it neceſſary; for, let it fall as it will, the fuze ſets fire to the powder within, which burſts the ſhell, and cauſes great devaſtation. The ſhells had much better be made of an equal thickneſs, for then they burſt into more pieces.

Meſſage-SHELLS, are nothing more than howitz ſhells, in the inſide of which a letter, or other papers, are put; the fuze-hole is ſtopt up with wood or cork, and the ſhells are fired out of a royal or howitz, either into a garriſon or camp. It is ſuppoſed that the perſon to whom the letter is ſent, knows the time, and accordingly appoints a guard to look out for its arrival.

Experiments with loaded SHELLS, *in* 1761, *Pruſſia*.

Nature of mortars	Powder in the chamber		Weight of the mortar			Strokes to drive fuze	Weight of ſhell fixed		Weight of powd. the ſhell cont.		Quantity of powder uſed		Fuze bur.	Elevation		Remarks
inch.	lb.	oz.	c.	qr.	lb.	N°.	lb.	oz.	lb.	oz.	lb.	oz.	"	"	'	Pieces the ſhell broke in
13	4	8	24	2	1	21	194		9	4½	8		16	30	30	18 pieces
	3						192½				7	8	19	45		26 do.
10	3	5	10	2	11	18	90		4	8	3	8	12	35	15	13 do.
	2						89	5			3	12	14	38	30	23 do.
Roy.		10		2	18	12	16		1	2	1		10	28	30	8 do.
		12				12	15	12				14	13	40		19 do.
Coeh.		5		2	28	10	8	4		8		7	12	30		6 do.
		5				10	8	5		8		6	14	38	30	12 do.

Weight of land-ſervice Shells, *and powder to fill them, as alſo the quantity of powder to burſt them into the greateſt number of pieces.*

Nature	Higheſt	Medium	Loweſt	Powder to fill them	Pow. to burſt them in moſt pieces
	C. Q. lb.	C. Q. lb.	C. Q. lb.	lb. oz.	lb. oz
13 inch	1 3 1	1 2 27	1 2 22	9 $4\frac{1}{2}$	7 8
10 inch	0 3 9	0 3 5	0 3 1	4 $14\frac{2}{3}$	3 4
8 inch	0 1 20	0 1 18	0 1 16	2 $3\frac{1}{2}$	2 0
$5\frac{1}{2}$ inch	0 0 15	0 0 $14\frac{1}{2}$	0 0 14	1 $1\frac{1}{2}$	0 14
$4\frac{2}{5}$ inch	0 0 8	0 0 $7\frac{1}{2}$	0 0 7	0 8	0 7

The above experiments, in 1760, with loaded ſhells, were the mediums of 6 ranges, and will be of great uſe to the unexperienced artilleriſt; as the beſt quantity of powder to make ſhells burſt in the moſt pieces, is not mentioned by any author I know.

SKINS. *Sheep-ſkins* are made uſe of to cover the mortars or howitzers between firing, to prevent any wet or dampneſs getting into them.

SHOOTING. See Gunnery, and Projectile.

SHOULDER *of a baſtion.* See Fortification.

Shoulder-*belt,* ſo called becauſe it hangs over the ſhoulder, to carry the trooper or dragoon's ſword: it is made of ſtrong buff leather.

SHOT, a denomination given to all kinds of balls uſed for artillery and fire-arms; thoſe for cannon being of iron, and thoſe for guns and piſtols, &c. of lead.

Grape
Chain } Shot. See Laboratory.
Caſe

Weight and number of Shot, *&c. for* Tin Cases, *for land and ſea ſervice.*

	Land ſervice		Sea ſervice		Weight of the		Length of the		Wooden bottom		Depth of the
Pounders	Weight of ſhot	Number of ſhot	Weight of ſhot	Number of ſhot	Land ſervice caſe	Sea ſervice caſe	Land ſervice caſe	Sea ſervice caſe	Length	Weight	Groove in the wooden bottom
	oz.	N°.	oz.	N°.	oz. dr.	oz. dr.	inch.	inch.	inch.	lb. oz.	inch.
42	6	94	$13\frac{1}{8}$	47	15 8		$8\frac{3}{4}$		$\frac{7}{8}$	5 2	$1\frac{1}{4}$
32	6	72	8	56	15		$8\frac{1}{4}$		$5\frac{6}{10}$	4	1
24	4	85	8	42	13 8		8		5	2	1
18	4	62	6	42	9 8		$7\frac{3}{4}$		$4\frac{1}{2}$	1 5	1
12	2	84	4	42	7 8		$6\frac{1}{4}$		$3\frac{1}{2}$	1 1	$\frac{7}{8}$
9	2	63	3	44	5 8		6		3	13	$\frac{6}{10}$ or $\frac{1}{2}$
6	$1\frac{1}{2}$	56	2	40	4 4		$4\frac{9}{10}$		3	$8\frac{1}{2}$	$\frac{6}{10}$
4			2	28		3 8	$4\frac{3}{10}$		$2\frac{6}{10}$	$6\frac{1}{4}$	$\frac{5}{10}$
3	$1\frac{1}{4}$	34	$1\frac{1}{2}$	31	2 4		$3\frac{9}{10}$		$2\frac{4}{10}$	$4\frac{1}{4}$	$\frac{5}{10}$
$1\frac{1}{2}$	$1\frac{1}{2}$	7			1 14		$3\frac{5}{10}$		$1\frac{9}{10}$	$2\frac{1}{4}$	$\frac{5}{10}$
8 H	6	81			14		$6\frac{1}{10}$		5	4	1
$5\frac{1}{2}$ H	3	55			8 8		$4\frac{1}{10}$		4	1 8	$\frac{8}{10}$
$4\frac{2}{5}$ H	2	54			6 8		$4\frac{1}{10}$		$3\frac{1}{2}$	1	$\frac{7}{10}$

N. B. H ſtands for howitzer.

SIDE-*pieces*, of *gun-carriages.* See CARRIAGES.

SIDE-*ſtraps*, in a *field-carriage*, are flat iron bands which go round the ſide-pieces, in thoſe places where the wood is cut acroſs the grain, to ſtrengthen them near the centre and the trail.

SIEGE, in the *art of war*, is to ſurround a fortified place with an army, and approach it by paſſages made in the ground, ſo as to be covered againſt the fire of the place. See Pl. XV.

The firſt operation of a *ſiege* is inveſting: the body of troops inveſting a town ſhould, at leaſt, be as ſtrong again as the garriſon: they divide themſelves into ſeveral parties, in order to take poſſeſſion of all the avenues leading to the place. By day they ſhould keep themſelves out of cannon-ſhot; but as ſoon as it is duſk, they muſt approach much nearer, the better to be able to ſupport each other, and to ſtraiten the town.

General phraſes and terms uſed at a SIEGE *are, viz.*

To beſiege a place. See SIEGE.

To accelerate the SIEGE, is when an army can approach ſo near the place as the covert-way, without breaking ground, under favour of ſome hollow roads, riſing grounds, or cavities, and there begin their work.

An attack, is when the beſieging army can approach the town ſo near as to take it, without making any conſiderable works.

To form a SIEGE, there muſt be an army ſufficient to furniſh 5 or 6 reliefs for the trenches, pioneers, guards, convoys, eſcorts, &c. an artillery, with all the apparatus thereto belonging; magazines furniſhed with a ſufficient quantity of all kinds of warlike ſtores; and an infirmary with phyſicians, ſurgeons, medicines, &c.

To raiſe a SIEGE, is to give over the attack of a place, quit the works thrown up againſt it, and the poſts formed about it. If there be no reaſon to fear a ſally from the place, the *ſiege* may be raiſed in the day-time. The artillery and ammunition muſt have a ſtrong rear-guard, leſt the beſieged ſhould attempt to charge the rear: if there be any fear of an enemy in front, this order muſt be altered diſcretionally, as ſafety and the nature of the country will admit.

To turn a SIEGE *into a blockade*, is to give over the attack, and endeavour to take it by famine; for which purpoſe all the avenues, gates, and ſtreams, leading into the place, are ſo well guarded, that no ſuccour can get to its relief.

To inſult a work, is a ſudden unexpected attack, with ſmall arms, or ſword in hand.

Surpriſe, is the taking a place by ſtratagem or treaſon.

To eſcalade a place, is to approach it ſecretly, then to place ladders againſt the wall, or rampart, for the troops to mount and get into it that way.

To petard a place, is privately to approach the gate and fix a petard to it, ſo as to break it open for the troops to enter.

Line of circumvallation, is a kind of fortification, conſiſting of a parapet, or breaſt-work, and a ditch before it, to cover the beſiegers againſt any attempt of the enemy in the field.

Line of countervallation, is a breaſt work, with a ditch before it, as the line of circumvallation, to cover the beſiegers againſt any ſally from the garriſon.

Lines, are works made to cover an enemy, ſo as to command a part of the country, with a breaſt-work and a ditch before it.

Retrenchment, a work made round the camp of an enemy, to cover it againſt any ſurpriſe.

An epaulement, is a breaſt-work of 8 or 10 feet high, to cover the cavalry. The breaſt-work of a battery is alſo called an epaulement.

Approaches, in a SIEGE, are works or trenches which the beſieging army make in the ground, in order to approach and make themſelves maſters of a fortified town, with as little loſs as poſſible.

Counter-approaches, are lines or trenches carried on by the beſieged, in attempting to attack the lines of the beſiegers in form, or to prevent approaches as much as poſſible.

Line of counter-approaches, a trench which the beſieged make from the covert-way to the right and left of the beſiegers attacks, in order to ſcour their works. This line muſt be perfectly enfiladed from the covert-way and the half-moon, &c. that it may be of no ſervice to the enemy, in caſe he gets poſſeſſion of it.

Batteries at a *ſiege*, cannot be erected 'till the trench is advanced within reach of the cannon of the place; that is, within what is generally underſtood to be a point-blank range, which is reckoned about 300 toiſes, or 1800 feet.

Cannon is made uſe of at a *ſiege* for two different purpoſes; the firſt, to drive away the enemy from their defences; and the ſecond, to diſmount their guns. To produce theſe two effects, the batteries ſhould not be above the mean reach of cannon-ſhot from the place: therefore there is no poſſibility of conſtructing them, 'till the firſt parallel is formed; and as the diſtance of the firſt parallel from the ſecond is generally 300 toiſes, the batteries muſt be on this line, or beyond it, nearer the town.

The conſtruction of batteries belongs to the officers of the royal artillery, who generally conſult with the engineer that has the direction of the ſiege, as well about their ſituation as about the number of their guns and mortars. They muſt be parallel to the works of the town which they are to batter. It is cuſtomary to place the mortar-batteries and gun-batteries ſide by ſide, and in the ſame line, to the end that they may batter the ſame parts. The uſe of both, as already obſerved, is to demoliſh the enemy's works, to diſmount their guns, to penetrate into their powder magazines, and to drive the beſieged from their works and defences; as alſo to ruin and deſtroy the principal buildings, by ſetting fire to the town; and to fatigue and diſtreſs the inhabitants in ſuch a manner, that they ſhall preſs the garriſon to ſurrender.

Biovack, is an extraordinary guard performed every night during a ſiege, to prevent any ſuccours from entering the town.

To bombard, is to throw ſhells into a beſieged place, in order to burn and deſtroy it, and by that means make the beſieged capitulate the ſooner.

Breach, is an opening made in the wall or rampart of a fortification, with cannon or mines, ſufficiently wide for a body of men to enter the works, and drive the beſieged out of it.

Camp, in a *ſiege*, is ranged all along the circumvallation, and within about 120 toiſes of it: the army fronts the circumvallation; that is, the troops have the line before and the town behind them.

Caiſſons, are ſmall caſes or cheſts, 2 or 3 feet long, and 1½ foot broad, which are filled with powder, and ſometimes with loaded ſhells: they are ſet fire to by means of a ſauciſſon, in the ſame manner as mines; when buried under the glacis, are productive of a very good effect. They ſhould never be placed nearer than 6 or 8 feet to the inſide of the covert-way, leſt they ſhould damage the troops that defend this poſt.

Capitulation, the conditions on which a place that is beſieged ſurrenders, being articles agreed on between the beſieged and beſiegers. The moſt honourable and ordinary terms of capitulation are, for the garriſon to march out at the breach with arms and baggage, drums beating, colours flying, matches lighted, with ſome pieces of artillery, waggons, and convoys for their baggage, and for the ſick and wounded, &c.

Caponier, a kind of double covert-way, made at the bottom of a dry ditch oppoſite the curtains, to communicate with the outworks. It alſo denotes a work or lodgement on the glacis of a place, ſunk 4 or 5 feet into the ground, with a parapet on each ſide, made with the earth thrown out of it, riſing about 2 feet above the ground, on which planks are laid, well covered with earth.

Cavalier of the trenches, is an elevation which the beſiegers make by means of gabions, within half way or 2-3ds of the glacis, to diſcover or to enfilade the covert-way. When this work (firſt invented by Mr. Vauban) is once finiſhed, it is very difficult for the enemy to remain any where in the covert-way; as they would be too much expoſed to the troops placed on the cavaliers.

Chamade, is when a town beſieged wants to capitulate, or to make ſome propoſals to the beſiegers. In that caſe one or more drums mount the rampart, and beat what the military call a *chamade*.

Chandeliers, are a kind of frames fit for holding a quantity of faſcines, in order to cover the workmen from the enemy's fire at a ſiege. They are made of two pieces of timber, raiſed perpendicularly on two other horizontal pieces, upon which they are ſupported on both ſides by braces. The ſpace between the two vertical pieces is filled with faſcines.

Chevaux-de-frize, are large joiſts or beams of timber, about 5 or 6 inches ſquare, and 10 or 12 feet long, through which paſs a number of wooden pins about 6 feet long, and 1½ inch diameter, ſhod with iron. They are made uſe of to ſtop up narrow paſſages, breaches, &c. during a ſiege.

Circumvallation, a work made of earth, conſiſting of a parapet and a ditch, with which towns are ſurrounded when beſieged. Very ſeldom uſed now.

To clear, is ſaid of thoſe who make a ſally, when they fill up the trench and beat off the enemy.

Countervallation, is a fortification made of earth like that of the circumvallation, the intent of which is to ſecure the troops employed in the *ſiege* againſt any inſult from the garriſon.

The beſieging army is between the circumvallation and the countervallation. The firſt fronts the county, and the ſecond the town. Almoſt out of uſe at preſent.

Epaulement, is the parapet of a battery of cannon or mortars at a ſiege. This name is alſo given to elevations of earth, which are ſometimes made in the lines, to cover the cavalry from the fire of the place. In a ſiege, *épaulements* are generally made 9 or 10 feet high, near the entrance of the approaches.

Eſcalade, is the attack of a place by ſurpriſe, and getting over the walls or rampart by the aſſiſtance of ladders.

Faſcines, are a kind of faggots made of ſmall branches of trees, or bruſh-wood, tied in 4 or 5 places; they are made from 2 to 10 feet long, and about 1 or 1½ feet diameter. Frequently uſed in ſieges.

Pitched faſcines, are ſuch as are daubed over with pitch and tar, in order to deſtroy the enemy's works.

Front attack, that part of a fortification, againſt which the beſiegers make their approaches, and point their artillery.

Blinds, are wooden frames of 4 pieces, round or flat, two of which are 6 feet long, and pointed at the ends, and the others 3 or 4 feet, which ſerve as ſpars to faſten the two firſt together. Their uſe is to fix them upright againſt the ſides of the ſaps, to ſuſtain the earth, and to faſten the faſcines on the upper part, or to cover the ſap, and to lay faſcines over them, to ſecure the troops from ſtones and grenades.

Gabions, are a kind of baſkets without a bottom, every where equally wide, 5 or 6 feet high, and about 3 in diameter, having 9 or 10 ſtakes of about 1½ inch in diameter; which exceed the baſket-work 5 or 6 inches, and are pointed, ſo as to ſtick into the ground. They are generally made by the miners and ſappers.

Stuft gabions, are large gabions filled with different things, to prevent their being perforated by muſket-ſhot: the ſappers roll them before them, to cover themſelves againſt the fire of the place.

Heriſſons, are large beams or trees, of the length of a breach made in a fortification, ſtuck thick with iron ſpikes, and rolled down upon the breach, to hinder the beſiegers from mounting: they are ſometimes made to ſlide with rollers.

Inſulting a work, is to make a ſudden and open attack upon it.

Inveſting a place, is to ſurround it with troops on all ſides, ſo that the town ſhall receive no ſuccours of men or proviſions. This is properly the firſt operation of a ſiege. The body of troops inveſting a town ſhould at leaſt be as ſtrong again as the garriſon: they are to divide themſelves into ſeveral parties, the better to take poſſeſſion of all the avenues leading to the place. By day they ſhould keep themſelves out of the reach of cannon-ſhot! but as ſoon as it is dark, they muſt approach much nearer, the better to be able to ſupport each other, and to ſtraiten the town.

The *inveſting* is generally made by cavalry; but when the country is cut with ravins, or hollow ways, or when there are woods in the neighbourhood of the place, then there muſt be likewiſe a body of infantry to guard all the avenues, and even to ſtop up, by a kind of retrenchments, ſuch as might be the eaſieſt to penetrate.

A few days after the *inveſting*, the beſieging army arrives, and is diſpoſed of round the town by the engineer, who directs the ſiege, and the lines are opened, &c.

Line of circumvallation. See CIRCUMVALLATION.

Line of countervallation. See COUNTERVALLATION.

Line of counter-approach. See APPROACH.

Lodgement, is a kind of retrenchment made openly in ſome part of a work, from whence the enemy have been driven, in order to maintain that poſt, and to be covered from the fire of the neighbouring works. It is always made by the beſiegers in ſome part of a fortification, after the beſieged have been driven out.

Opening of the trenches, is when the workmen begin to dig them, at the firſt commencement of a ſiege.

Parallels, or *places of arms*, are a part of the trenches, which ſurround the whole front attacked, and ſerve to hold the ſoldiers, who are to protect and ſupport the workmen: they are about 8 or 10 feet deep, and 16 or 18 feet wide.

Park, in *artillery*, is the place where all the ammunition and magazines are ſecured for an army carrying on a ſiege. It muſt be in ſome part moſt remote from the town, and the leaſt expoſed to be inſulted, but on the ſame ſide where the attack is to be made: it is generally made in the form of a ſquare redout, with a breaſt-work and a ditch round it, and the entrance covered with a redan, or ſmall ravelin.

Pickets, are a kind of ſtakes, ſharp at one end, to hold the faſcines together in making ſaps, lodgements, and filling up of ditches, &c.

in a ſiege. They are 3 feet long, and about 1½ inch diameter.

Place of arms, in the operations of a ſiege, is what we generally call the parallels. They are the parts of a trench oppoſite to the front attacked.

Place of arms, in a dry ditch, is a kind of covert-way made at the extremity of the faces to defend the ditch at a ſiege.

Quarter, at a *ſiege*, is a part of the army, conſiſting of one or more brigades, and generally under the command of a general officer. It likewiſe implies the incampment of the beſiegers.

Sally, at a *ſiege*, is when a body of troops go privately out of a beſieged town, fall ſuddenly upon the beſiegers, and deſtroy part of their works, nail their cannon, and do every other damage they can.

Sand-bags, are made about 2' feet high, and 8 or 10 inches diameter: they are filled with earth, and cover the workmen in making their approaches. They are ſometimes placed on the ramparts, three together, for the troops to fire through.

Saps, in a *ſiege*, are trenches made under cover from the fire of the place, behind a mantlet or ſtuft gabion: they are generally 10 or 12 feet broad. This work differs from the trenches, in as much as the latter are made uncovered. The ſap has alſo leſs breadth; but when it is as wide as the trench, it bears the ſame name. There are various ſorts of ſaps, viz.

Single ſap, is that which is made on one ſide only, or, which is the ſame thing, has only one parapet.

Double ſap, has a parapet on each ſide, and is carried on wherever its two ſides are ſeen from the place.

Flying ſap, is that in which the beſiegers do not give themſelves the trouble of filling the gabions with earth: it is made where the workmen are not much expoſed, and in order to accelerate the approaches.

Sap-faggots, are a kind of faſcines, but only 3 feet long, and about 6 inches in diameter.

Sauciſſes, are another ſpecies of faſcines, from 12 to 19 feet long, and from 8 to 10 inches in diameter, and are uſed in making batteries, and repairing the breaches.

Sortie. See *Sally*.

Trail, or *rear of the trench*, is the firſt work the beſiegers make when they open the trenches.

Tambour, is a kind of traverſe, at the upper end of the trench or opening made in the glacis to communicate with the arrows. This work hinders the beſiegers from being maſters of the arrow, or diſcovering the inſide of the place of arms belonging to the covert-way.

Traverſes, in a *ſiege*, is a name given to a kind of retrenchment made in the dry ditch, to defend the paſſage over it.

Trenches, are a kind of paſſages or turnings dug in the earth, in order to approach a place without being ſeen from its defences.

To turn a work, is to cut off its communication with the place, endeavouring to take it by its gorge. A work is ſaid to be turned when the beſiegers get between that work and the place.

Wool-packs, uſed in a *ſiege*, differ from ſand-bags, in this only, that they are much larger, and inſtead of earth they are filled with wool. They are uſed in making lodgements in places where there is but little earth, and for other ſimilar purpoſes. They are about 5 feet high, and 15 inches diameter.

Rear of an attack, is the place where the attack begins.

Front, or head of an attack, that part next to the place.

Mantlets, are wooden fences, rolling upon wheels, of 2 feet diameter; the body of the axle-tree is about 4 or 5 inches ſquare, and 4 or 5 feet long; to which is fixed a pole of 8 or 10 feet long, by two ſpars; upon the axle-tree is fixed a wooden parapet, 3 feet high, made of 3-inch planks, and 4 feet long, joined with dowel-pins, and two croſs-bars: this parapet leans ſomewhat towards the pole, and is ſupported by a brace, one end of which is fixed to the pole, and the other to the upper part of the parapet. They are uſed to cover the ſappers in front againſt muſket-ſhot.

Crows-feet, or *Chauſſe-trap*, } is a kind of iron, with 4 points, ſo diſpoſed, as always to have 3 points downwards, and 1 upwards: they ſerve alſo to ſtop the horſe.

Maxims in SIEGES are, 1ſt. The approaches ſhould be made without being ſeen from the town, either directly, obliquely, or in the flank.

2. No more works ſhould be made than are neceſſary for approaching the place without being ſeen; i. e. the beſiegers ſhould carry on their approaches the ſhorteſt way poſſible, conſiſtent with being covered againſt the enemy's fire.

3. All the parts of the trenches ſhould mutually ſupport each other; and thoſe which are fartheſt advanced, ſhould be diſtant from thoſe that defend them above 120 or 130 toiſes, that is, within muſket-ſhot.

4. The parallels, or places of arms the moſt diſtant from the town, ſhould have a greater extent than thoſe which are the neareſt, that the beſiegers may be able to take the enemy in flank, ſhould they reſolve to attack the neareſt parallels.

5. The trench ſhould be opened or begun as near as poſſible to the place, without expoſing the troops too much, in order to accelerate and diminiſh the operations of the ſiege.

6. Care ſhould be taken to join the attacks; that is, they ſhould have communications, to the end that they may be able to ſupport each other.

7. Never to advance a work, unleſs it be well ſupported; and for this reaſon; in the interval between the 2d and 3d place of arms, the beſiegers ſhould make, on both ſides of the trenches, ſmaller places of arms, extending 40 or 50 toiſes in length, parallel to the others, and conſtructed in the ſame manner, which will ſerve to lodge the ſoldiers in, who are to protect the works deſigned to reach the 3d place of arms.

8. Obſerve to place the batteries of cannon in the continuation of the faces of the parts attacked, in order to ſilence their fire; and to the end that the approaches, being protected, may advance with great ſafety and expedition.

9. For this reaſon the beſiegers ſhall always embrace the whole front attacked, in order to have as much ſpace as is requiſite to place the batteries on the produced faces of the works attacked.

10. Do not begin the attack with works that lie cloſe to one another, or with rentrant angles, which would expoſe the attack to the croſs fire of the enemy.

Stores required for a month's Siege *are as follow:*

Powder, as the garriſon is more or leſs ſtrong		8 or 900,000 lb.
Shot	for battering pieces	6000
	of a leſſer ſort	20,000
Battering cannon		80
Cannons of a leſſer ſort		40
Small field-pieces for defending the lines		20
Mortars for throwing	ſhells	24
	ſtones	12
Shells for mortars		15 or 16,000
Hand grenades		40,000
Leaden bullets		180,000
Matches in braces		10,000
Flints for muſkets, beſt ſort		100,000
Platforms complete for guns		1200lb.
Platforms for mortars		60
Spare	carriages for guns	60
	mortar-beds	60
	ſpunges, rammers, and ladles, in ſets	20
Tools to work in trenches		40,000

Several hand-jacks, gins, ſling-carts, travelling forges, and other engines proper to raiſe and carry heavy burthens; ſpare timber, and all ſorts of miners tools, mantlets, ſtuffed gabions, faſcines, pickets, and gabions.

SIGNAL, in the *art of war*, a certain ſign agreed upon for the conveying intelligence, where the voice cannot reach. *Signals* are frequently given for the beginning of a battle, or an attack, uſually with drums and trumpets, and ſometimes with ſky-rockets, &c.

Signal-*flags*, in *ancient military hiſtory*, was a gilded ſhield hung out of the admiral's galley; it was ſometimes a red garment or banner, termed ἀλεξιν. σημεῖα.. During the elevation of this the fight continues, and by its depreſſion or inclination towards the right or left, the reſt of the ſhips were directed how to attack their enemies, or retreat from them.

SILLON, in *fortification*, is a work raiſed in the middle of a ditch, to defend it when it is too wide. It has no particular form; ſometimes made with little baſtions, half-moons, and redans, which are lower than the works of the place, but higher than the covert-way. It is more frequently called *envelope*, which ſee.

SIMILAR *polygons*, are ſuch as have their angles ſeverally equal, and the ſides about thoſe angles proportional.

SIMITAR, in *war*, a crooked or falcated ſword, with a convex edge. Not in uſe now.

SIXAIN, in *ancient military hiſtory*, an order of battle, wherein ſix battalions being ranged in one line, the 2d and 5th are made to advance, and form the van-guard; the 1ſt and 6th to retire, and form the rear-guard; the 3d and 4th, remaining on the ſpot, to form the body of the battle.

SKIRMISH, in *war*, a diſorderly kind of combat, or encounter, in preſence of two armies, between ſmall parties who advance from the main body for that purpoſe, and introduce, or invite to, a general fight.

SLEEPERS, the undermoſt timber of a gun or mortar-battery. See Platform.

SLEETS, are the parts of a mortar going from the chamber to the trunnions, to ſtrengthen that part.

SLING-*cart*. See Carriage.

SOCIETY, in *general*, denotes a number of perſons united together for their aſſiſtance in promoting the arts and ſciences, ſecurity, intereſt, or entertainment.

SOLDIER, a military man liſted to ſerve a prince or ſtate, in conſideration of a certain daily pay.

Soldiers are properly the land-forces of a kingdom, or ſtate; but in England it is againſt the ancient law to keep an army of ſoldiers in time of peace. Where any ſoldier that is lawfully retained ſhall depart from his colours without leave, he is declared to be guilty of felony by 18 Hen. VI. c. 9. and every ſoldier, who either cauſes a mutiny, or deſerts the ſervice, ſhall be puniſhed with death, or otherwiſe, as a court-martial ſhall think fit. All perſons ſuſpected of deſertion are to be apprehended by conſtables, who ſhall be allowed a reward of twenty ſhillings for every ſuch deſerter.

By 4 Geo. I. c. 4. it is ordained, that no ſoldier ſhall be taken out of the ſervice by any proceſs in law, unleſs it be for ſome criminal matter, or where the debt he owes amounts to ten pounds at the leaſt; of which affidavit is to be made, &c. Soldiers muſt be quartered in inns and ale-houſes only, and not in private houſes, without the conſent of the owners, under certain penalties; and where victuallers refuſe ſoldiers quartered on them, or conſtables receive any reward for excuſing their neglect, they forfeit a ſum not above fifty pounds, nor under thirty ſhillings, by 3 Geo. II. c. 2. A perſon inliſted for a ſoldier, within four days after, is to be carried before the next juſtice or chief magiſtrate of a town, and is to declare his aſſent that he liſted voluntarily, &c.; but if he then diſſents therefrom, on his returning the money received, and paying twenty ſhillings, he may be diſcharged. In caſe any ſubject of Great-Britain or Ireland ſhall liſt or enter himſelf, or procure any one to be inliſted a ſoldier to go beyond the ſeas, without leave obtained from his Majeſty, ſuch perſon ſhall be puniſhed as a felon by 8 and 9 Geo. II. There are acts annually made for puniſhing mutiny, &c. of ſoldiers and falſe muſters, and for the better payment of the army and their quarters.

SOLID *baſtion*. See Fortification.

SOMMERS, in an *ammunition-waggon*, are the upper ſides, ſupported by the ſtaves entered into them with one of their ends, and the other into the ſide-pieces.

SORTIES, in a *ſiege*, parties that ſally out of a town ſecretly to annoy the beſiegers, and retard their operations.

SOUND. The experiments are numerous by which it has been found, that ſound is audible to the diſtance of 50, 60, or 80 miles; but Dr. Hearne, phyſician to the king of Sweden, tells us, that at the bombardment of Holmia, in 1658, the ſound was heard 30 Swediſh miles, which make 180 of ours: and in the fight between England and Holland in 1672, the noiſe of the guns was heard even in Wales, which cannot be leſs than 200 miles.

The velocity of ſound is 380 yards, or 1142 feet in a ſecond of time, as found by very accurate experiments. Hence the following

Table of the progreſſion of SOUND.

ſeconds	yards	feet	inches	ſeconds	yards	feet	inches	ſeconds	yards	feet	inches	ſeconds	yards	feet	inches	ſeconds	yards	feet	inches
1	380	2		4½	1731			8	3045	1		11½	4377	2		15	5710		
1¼	475	2	6	4¾	1808	1		8¼	3140	1	6	11¾	4472	2	6	15¼	5805		6
1½	571			5	1903	1		8½	3235	2		12	4568			15½	5900	1	
1¾	656		6	5¼	1998	1	6	8¾	3310	2	6	12¼	4663		6	15¾	5995	1	6
2	761	1		5½	2093	2		9	3426			12½	4758	1		16	6090	2	
2¼	856	1	6	5¾	2188	2	6	9¼	3521		6	12¾	4853	1	6	16¼	6185	2	6
2½	951	2		6	2284			9½	3616	1		13	4948			16½	6281		
2¾	1046	2	6	6¼	2379		6	9¾	3711	1	6	13¼	5043		6	16¾	6376		6
3	1142			6½	2474	1		10	3806	2		13½	5139			17	6471	1	
3¼	1239		6	6¾	2569	1	6	10¼	3901	2	6	13¾	5234		6	17¼	6566	1	6
3½	1332	1		7	2664	2		10½	3997			14	5392	1		17½	6661	2	
3¾	1427	1	6	7¼	2759	2	6	10¾	4052		6	14¼	5421	1	6	17¾	6756	2	6
4	1522	2		7½	2855			11	4187	1		14½	5469	2		18	6851		
4¼	1617	2	6	7¾	2950		6	11¼	4282	1	6	14¾	5574	2	6	18¼	6946		6

By this table we can eaſily meaſure the diſtance of the clouds producing thunder and lightening; for ſuppoſe, from the moment we obſerve the flaſh, to the moment we hear the ſtroke of thunder, we count four ſeconds; which find in the table; and oppoſite thereto, you will find 1522 yards, 2 feet, for the diſtance of the cloud. In like manner the diſtance of ſhips at ſea, of batteries in a ſiege, &c. is known by firing of guns. *Example:* On ſeeing the flaſh of powder, count the ſeconds 'till you hear the report, which ſuppoſe 2¼, the number oppoſite thereto is 856 yards, 1 foot, and 6 inches, the diſtance of the gun from the place you ſtand at. The horizontal range of a ſhell may likewiſe be found in this table. *Example:* Square the number of ſeconds, multiply that product by $16\frac{1}{12}$, and divide by 3, which gives the number of yards of a horizontal projection at 45°: or, to avoid fractions, multiply the ſeconds by 193, and divide by 36, which gives the ſame anſwer. For $12 \times 12 = 144 \times 16\frac{1}{12} = \frac{2316}{3} = 772$: or $12 \times 12 = 144 \times 193 = \frac{27792}{36} = 771$ as before.

The exactneſs of meaſuring diſtances by ſound, has been ſufficiently proved, by meaſuring the ſame diſtances by trigonometry.

SOW, in *ancient military hiſtory*, a kind of covered ſhed, fixed on wheels, under which the beſiegers filled up and paſſed the ditch, ſapped or mined the wall, and ſometimes worked a kind of ram. It had its name from its being uſed for rooting up the earth like a ſwine, or becauſe the ſoldiers therein were like pigs under a ſow.

SPATTERDASHES, a kind of covering for the legs of ſoldiers, made of coarſe linen waxed over, and buttoned tight; by which the wet is kept off.

SPATTS, a ſmall ſort of ſpatterdaſhes, that reach only a little above the ancle, much worn by the royal artillery, and gentlemen cadets.

SPIES, in *war*, are perſons employed to give intelligence of what the enemy is doing. They ſhould be well paid: who pays them ill, is never well ſerved. They ſhould never be known to any body, nor ſhould they know one another. When they propoſe any thing very material, ſecure their perſons, or have their wives and children as hoſtages for their fidelity. If they are apprehended, they immediately ſuffer death.

Spies are found in the cabinets of princes, in the cloſets of miniſters, amongſt the officers of the army, and in the councils of generals; in towns belonging to the enemy, and in monaſteries. The greateſt generals ſtrongly recommend them, whatever expence they may occaſion; and indeed a commander had better be in want of many particulars, however neceſſary, than be deſtitute of ſpies. Nothing ſhould be ſpared to procure them; and even the promiſes made to them ſhould be obſerved with the moſt inviolable integrity.

SPLICE. A rope is ſaid to be *ſpliced*, when the ſeveral ſtrands of each end, being untwiſted, are wrought into one another in a peculiar manner, known to all artillery-men.

SPIKES, in *gunnery*. See Hand-Spikes.

SPIN, or *to ſpin hay*, is to twiſt it up in ropes, very hard, for an expedition; by which means it is leſs bulky, and leſs troubleſome for the cavalry to carry behind them. An expert horſeman can ſpin five days forage into a very narrow compaſs.

SPONTOON, is a weapon much like a halberd, now uſed inſtead of a half-pike by the officers of foot. When the ſpontoon is planted, the regiment halts; when pointed forwards, the regiment marches; and when pointed backwards, the regiment retreats.

SPONGE, in *gunnery*, is a cylinder of wood fixed to a handle, whoſe diameter and length are equal to the ſhot in guns, covered with a lamb-ſkin to clean the piece with, after it has been fired.

SPURS, in *old fortifications*, are walls that croſs a part of the rampart, and join to the town-wall.

SQUADRON, a body of cavalry, compoſed of three troops. The number is not fixed, but is generally from 80 to 120 men. The eldeſt troop always takes the right of the ſquadron, the ſecond the left, and the youngeſt the centre.

SQUADS, in a *military ſenſe*, are certain diviſions of a company into ſo many ſquads, generally into 3 or 4. The uſe of forming companies into as many ſquads of inſpection as it has ſerjeants and corporals, is proved by thoſe regiments who have practiſed that method; as by it the irregularity of the ſoldiers is conſiderably reſtrained, their dreſs improved, and the diſcipline of the regiment in general moſt remarkably forwarded. Every officer ſhould have a roll of his company by ſquads.

SQUARE *battalion of men*, is that which is compoſed of an equal number of men in rank and file. To make a ſquare battalion of men, whoſe number is known, as 50, take the neareſt ſquare root, which is 5, for the number of men in rank and file.

Square *battalion of ground*, the number being likewiſe determined, as 60, that number muſt be multiplied by 3, the number of feet that each man takes in front, and the product, 180, divided by 7, the number of feet each man takes up in depth, or the diſtance of the ranks: the quotient is 25, the ſquare root of which is 5, the number of men in each file: by the root 5 you divide 60; the quotient is 12, the number of men in each rank.

Solid Square, is a body of foot, where both ranks and files are equal. It was formerly held in great eſteem; but when the prince of Naſſau introduced the hollow ſquare, this was ſoon neglected. Both the ſolid and hollow ſquare are almoſt exploded from tactics.

Hollow Square, is a body of foot drawn up with an empty ſpace in the centre, for the colours, drums and baggage, facing every way to charge the horſe.

STAFF, in *military matters*, conſiſts of a quarter-maſter-general, adjutant-general, and majors of brigade. The ſtaff properly exiſts only in time of war. See Quarter-master-general, &c.

Regimental Staff, conſiſts in the adjutant, quarter-maſter, chaplain, and ſurgeon, &c.

STANDARD, in *war*, a ſort of banner or flag, borne as a ſignal for the joining together of the ſeveral troops belonging to the ſame body.

The ſtandard is uſually a piece of ſilk 1½ feet ſquare, on which is embroidered the arms, device, or cypher, of the prince or colonel. It is fixed on a lance 8 or 9 feet long, and carried in the centre of the firſt rank of a ſquadron of horſe, by the cornet.

STAPLES, in *artillery carriages*, are driven into the ſide-pieces of gun and mortar carriages, to faſten the keys of the eye-bolts by means of chains: there are alſo ſtaples to the lockers of gun-carriages, &c.

STAR-*fort*, in *fortification*. See Fort, and Fortification.

STAVES, round and flat, uſed in ammunition and other waggons or carts, are round and flat ſticks between the ſommers and ſide-pieces, alſo in common and ſcaling ladders.

STAYS, in *truck carriages*, are the irons which are fixed one end under the fore axle-tree, and the other to the ſide-pieces, in the form of an S.

STEGANOGRAPHY, the art of ſecret writing, or of writing in cyphers, known only to perſons correſponding, and much uſed in the army.

STOLE. See ORDER OF THE STOLE.

STONES, in *military architecture*, may be diſtinguiſhed into two ſorts; that is, into hard and ſoft: hard ſtone is that which is expoſed to the open air, ſuch as rocks, and which lies looſe upon the ſurface of the earth: the ſoft ſtone is that which is found in quarries, and under ground. It is undoubtedly true that the hardeſt ſtones make the moſt durable works; but as there is ſeldom a ſufficient quantity to build the whole fortification, the beſt ſerve in the facings of the work, in the foundations, and where the works are expoſed to the violence of the waves.

The ſtones of ſome quarries are very ſoft, and eaſily worked, when firſt taken out; but, when expoſed for ſome time to the open air, become very hard and durable.

As there is undoubtedly a kind of ſap in ſtones as well as in timber, by which the ſame ſort of ſtone, taken out of the ſame quarry, at one ſeaſon, will moulder away in a few winters, but, when dug out in another ſeaſon, will reſiſt the weather for many ages; ſtones ſhould always be dug up in the ſpring, that they may have time to dry before the cold weather comes in; for the heat of the ſun will extract the greateſt part of the moiſture, which otherwiſe expands in froſty weather, and cauſes the ſtone to ſplinter (as example teaches) although it is otherwiſe hard and good.

As ſtones lie in the quarries in horizontal beds or ſtrata, (that is, they cleave in that direction) and have likewiſe a breaking vein, which is perpendicular to the former; both theſe directions muſt be obſerved in cleaving, as well as raiſing them out of their beds. Stones that will not eaſily cleave muſt be blown up by gunpowder.

Marble, is of various ſorts and colours; the moſt beautiful of which is exported from abroad. The marble found in England is moſtly blackiſh, and ſo very hard and difficult to poliſh, that very little uſe is made of it, except to burn and make lime.

Fire-STONES, come from Reygate, and ſerve chiefly for chimneys, hearths, ovens, furnaces, and ſtoves; being a dry, porous, gritty ſtone, which bears the heat without breaking: on account of this quality, it is called *fire-ſtone*.

Purbeck-STONE, is a hard, greyiſh ſtone, and ſerves chiefly for paving, coping of walls, and for all ſuch other uſes where ſtrength is required, it being the moſt hard and durable ſtone, except the Plymouth marble. It is found on Purbeck iſland.

Rag-STONE, is of a bluiſh colour, and commonly uſed in paving: but there is a ſtone called *Kentiſh rag*, that is very uſeful in building; they ſplit very eaſily, and yet are very hard.

Free-STONE, more generally called *Portland-ſtone*: it is a fine whitiſh ſtone, without any veins. This ſtone is very ſoft when it comes out of the quarry, works very eaſily, and becomes very hard in time. Hence it is very fit for military works. It coſts about nine-pence a cubic foot upon the ſpot.

Alabaſter, is a clear whitiſh ſtone, not unlike coarſe marble. It is plentiful in ſome parts of Italy; but there is none to be found in England. It is to be had in great abundance in Scotland, and makes the very beſt of lime.

Whin, or *Aberdeen whin*, is of a greyiſh colour, intermixed with veins, not unlike coarſe marble. This ſtone is the fitteſt of any for military works; becauſe it withſtands the weather, and the violence of the waves, better than any ſtone found in England.

STOPPAGES, in a *military ſenſe*, is a deduction of ſome part of a ſoldier's pay, the better to provide him with neceſſaries. A ſoldier ſhould never be put under a greater weekly ſtoppage from his pay, than what will afterwards leave him a ſufficiency for meſſing. Six-pence a week, beſides arrears, is as much as they can ſpare.

STORE-*keeper*, in *war-time*, muſt take care of the ſtores in the magazines, ſuch as the proviſions, forage, &c. receive the ſame from the contractors, and deliver them out to the troops. He has ſeveral clerks under him, appointed to the different departments, of proviſions, hay, ſtraw, oats, &c. In time of peace he has charge of all the king's ſtores, belonging both to land and ſea-ſervice.

STORM, in *military affairs*. See STRATAGEM.

STRATARITHMOMETRY, in *war*, the art of drawing up an army, or any part of it, in any given geometrical figure; and of expreſſing the number of men contained in ſuch a figure, as they ſtand in order of battle, either at hand, or at any diſtance aſſigned.

STRATAGEM, in *war*, any device for the deceiving and ſurpriſing an army, or any body of men. See SURPRISE.

STRAW. *For ſtrew!* is a word of command to diſmiſs the ſoldiers when they have grounded their arms, ſo that they may be ready on the firſt ſignal given.

STREAKS, are the iron bands on the outſide of the wheel to bind the fellies ſtrongly together.

STREAK-*nails*, are thoſe driven through the ſtreaks into the fellies.

SUBALTERN. See OFFICER.

SUB-*brigadier*, an officer in the horſe-guards, who ranks as cornet.

SUB-*lieutenant*, an officer in the royal regiment of artillery and fuzileers, where they have no enſigns; and is the ſame as ſecond lieutenant.

SUBORDINATION, in *military matters*, conſiſts in a perfect ſubmiſſion to the orders of ſuperiors; in a perfect dependence, regulated by the rights and duties of every military man, from the ſoldier to the general. *Subordination* ſhould ſhow the ſpirit of the chief in all the members; and this ſingle idea, which diſplays itſelf to the leaſt attention, ſuffices to ſhow its importance. Without *ſubordination* it is impoſſible that a corps can ſupport itſelf; that its motions can be directed, order eſtabliſhed, or the ſervice carried on. In effect, it is *ſubordination* that gives a ſoul and harmony to the ſervice; it adds ſtrength to authority, and merit to obedience; it ſupports the ſtaff of the marſhal, as the ſword of the ſoldier, which ſecures the efficacy of the command, and the honour of the execution: it is *ſubordination* which prevents every diſorder, and procures every advantage to an army.

SUBSISTENCE, in the *military art*, is the money paid, weekly or monthly, to both officer and ſoldier, but not amounting to their full pay: the difference is called *arrears*. See PAY.

SUCCOUR, in *war*, the effort made to relieve a place; that is, to raiſe the ſiege, and force the enemy from it.

SULPHUR, or *brimſtone*, a mineral, very uſeful in making gun-powder and artificial fire-works.

SURFACE, in *fortification*, is that part of the ſide which is terminated by the flank prolonged, and the angle of the neareſt baſtion: the double of this line with the curtain is equal to the exterior ſide.

SURPRISE, in *war*, to fall on an enemy unexpectedly, in marching through narrow and difficult paſſes, when one part has paſſed, ſo as not eaſily to come to the ſuccour of the other; as in the paſſage of rivers, woods, encloſures, &c. A place is ſurpriſed by drains, caſe-mates, or the iſſues of rivers or canals; by encumbering the bridge or gate, by waggons meeting and ſtopping each other; ſending ſoldiers into the place, under pretence of being deſerters, who, on entering, *ſurpriſe* the guard, being ſuſtained by troops in ambuſh near the place, to whom they give entrance, and ſeize it; ſoldiers ſometimes dreſſed like peaſants, merchants, Jews, prieſts, or women. The enemy ſometimes ſend in their ſoldiers, as if they were yours coming from the hoſpital, &c. they alſo dreſs their ſoldiers in your regimentals, who, preſenting themſelves at your gate as ſuch, are immediately admitted, ſeize the guard, and become maſters of the place. Sometimes houſes are ſet on fire, and whilſt the garriſon comes out to extinguiſh it, troops who lay in ambuſh march in, and ſurpriſe the place. Officers commanding guards at the principal gates are lured out under various pretences, ſo contrived as to ſeize the gate in coming in with them. Sometimes an alarm is given at one ſide of the garriſon, whilſt you enter ſecretly at the other, at that time too often neglected.

SURRENDER, in *war*, to lay down your arms, and ſurrender yourſelf priſoner; to give over a town, poſt, or other fortification, agreeably to articles, &c.

SURVEYOR *of the ordnance*. See ORDNANCE.

SUTLER, in *war*, one who follows the army, and furniſhes proviſions for the troops. They pitch their tents, or build their huts, in the rear of each regiment, and about head quarters.

SWALLOWS-*tail*, in *fortification*, an outwork, differing from a ſingle tenaille, as its ſides are not parallel, like thoſe of a tenaille; but if prolonged, would meet and form an angle on the middle of the curtain; and its head or front compoſed of faces, forming a re-entering angle. This work is extraordinarily well flanked, and defended by the works of the place, which diſcover all the length of its long ſides, &c.

SWEEP-*bar*, of a waggon, is that which is fixed on the hind part of the fore-guide, and paſſes under the hind pole, which ſlides upon it.

SWING-*tree*, of a waggon, the bar faſtened acroſs the fore-guide, to which the traces of the horſes are faſtened.

SWORD, an offenſive weapon worn on the left ſide, and ſerving either to cut or ſtab: its parts are the handle, guard, and blade; to which may be added the bow, ſcabbard, chape, and pummel.

Broad-SWORD, an original weapon of Scotland; it is ſometimes called a back-ſword, as having but one edge: it is baſket-handled, and 3 feet 2 inches long.

SWORD-*belt*, generally made of leather, ſometimes of ſilk, and ſometimes of ſteel chains: it is worn about the waiſt, to carry the ſword in.

T

TABLES, in *military affairs*, a kind of regiſter to ſet down the dimenſions of carriages for guns, mortars, &c. alſo for the practice of artillery, charges of mines, &c. See SUPPLEMENT.

TACKLES, are more particularly uſed for ſmall ropes running in pullies, the better to manage all kinds of ordnance. See GIN.

TACTICS, in the *art of war*, the art of diſciplining armies, and ranging them into forms proper for fighting and manœuvring, &c.

In the time of the Romans, the Gauls and other nations on the continent fought in the phalanx order. It is this order which ſtill prevails through all Europe, except that it is deficient in the advantages and utility which Polybius aſcribes to it, and is injured and diſgraced by defects unknown in the ancient phalanx.

In Turenne's days troops were ranged 8 deep both in France and Germany. Thirty years after, in the time of Puyſegur, the ranks were reduced to 5, in the laſt Flanders war to 4, and immediately after to 3.

This part of the progreſſion from 8 to 3, being known, we eaſily conceive how the files of the phalanx had been diminiſhed from 16 to 8, in the ages preceding Turenne. It is to be preſumed that this depth was conſidered as ſuperfluous, and it was judged neceſſary to curtail it, in order to extend the front. However, the motion is of very little conſequence; we are now reduced to 3 ranks: let us endeavour to find out what qualities of the phalanx have been preſerved, and what might have been added thereto.

To ſhew that we have preſerved the defects of the phalanx in Europe, I ſuppoſe 2 bodies of troops, one of 8,000 men, ranged as a phalanx, 15 deep; the other, a regiment of 3 battalions, conſiſting only of 1500 men, drawn up in 3 lines after the ſame manner. Thoſe two bodies ſhall be perfectly equal in extent of front, and ſhall differ in nothing but in the depth of their files: the inconveniences and defects, therefore, occaſioned by the length of the fronts, are equal in both troops, though their numbers are very different: hence it follows, that in Europe the eſſential defects of the phalanx are preſerved, and its advantages loſt.

Let the files of this body, of 8,000, be afterwards divided, and let it be reduced to 3 in depth; its front will then be found 5 times more extenſive, and its depth 5 times leſs: we may therefore conclude, that the defects of the phalanx are evidently multiplied in the tactics of Europe, at the expence of its advantages, which conſiſted in the depth of its files.

The progreſs of the artillery has contributed greatly to this revolution. As cannon multiplied, it was neceſſary to avoid its effects; and the only method of doing it, was doubtleſs to diminiſh the depth of the files.

TAIL *of the trenches*, is the poſt where the beſiegers begin to break ground, and cover themſelves from the fire of the place, in advancing the lines of approach. See TRENCHES.

TALUS, in *fortification*, a ſlope made to the works of a fortification, both on the outſide and inſide, to prevent the earth from rolling down.

Exterior Talus, is the outſide ſlope of a work towards the country, and ſhould be as ſmall as poſſible, that the enemy may not find it eaſy to be mounted, either by eſcalade or otherwiſe: but if the earth be not good, the talus muſt be large, that it may keep it up the better: then it is neceſſary to ſupport the earth with a ſlight wall, called a *revêtement*.

Interior Talus, the inſide ſlope of a work next the town, which is much larger than that of the outſide, and has, at the angles of the gorge, and ſometimes in the middle of the curtain, ramps or ſloping roads, to mount upon the terre-plein of the rampart. The interior talus of the parapet ſhould be very ſmall, that men may fire over it with more eaſe.

Superior Talus *of the parapet*, is a ſlope on the top of the parapet, that allows of the ſoldiers defending the covert-way with ſmall ſhot, which they could not do were it level.

TAMBOUR, in *fortification*, is a kind of work formed of palliſades, or pieces of wood, 10 feet long, and 6 inches thick, planted cloſe together, and driven 2 or 3 feet into the ground; ſo that, when finiſhed, it may have the appearance of a ſquare redout cut in two. Loop-holes are made 6 feet from the ground, and 3 feet aſunder, about 8 inches long, 2 inches wide within, and 6 without. Behind is a ſcaffold 2 feet high, for the ſoldiers to ſtand upon. They are frequently made in the place of arms of the covert-way, at the ſalient angles, in the gorges, half-moons, and ravelins, &c.

TAMPIONS, }
TOMPIONS, } are wooden cylinders to put into the mouth of the guns, howitzers, and mortars, in travelling, to prevent the duſt or wet getting in. They are faſtened round the muzzle of the guns, &c. by leather collars.

They are ſometimes uſed to put into the chambers of mortars, over the powder, when the chamber is not full.

Tampions, in *ſea ſervice artillery*, are the iron bottoms, to which the grape-ſhot are fixed; the dimenſions of which are as follow, viz.

42-pounders		$6\frac{6}{10}$	inches diameter
32 ditto	-	6	
24 ditto	-	$5\frac{4}{10}$	
18 ditto	-	$4\frac{9}{10}$	
12 ditto	-	$4\frac{3}{10}$	
9 ditto	-	$3\frac{9}{10}$	
6 ditto	-	$6\frac{1}{4}$	
4 ditto	-	$2\frac{9}{10}$	
$1\frac{1}{2}$ ditto	-	$2\frac{1}{10}$	
$\frac{1}{2}$ ditto	-	$1\frac{4}{10}$	

TARGET, a ſort of ſhield, being originally made of leather, wrought out of the back of an ox's hide. They are much uſed by the Scotch.

Target, is alſo a mark for the artillery to fire at, in their practice.

TARPAULINGS, are made of ſtrong canvaſs, thoroughly tarred, and cut into different ſizes, according to their ſeveral uſes in the field; ſuch as to cover the powder-waggons, and tumbrels (carrying ammunition) from rain: each field-piece has likewiſe one to ſecure their ammunition-boxes.

TAP-TOO, }
TATT-TOO, } See Drum.

TECHNICAL *terms*, are all terms of art, uſed in a military ſenſe, &c.

TE DEUM, as far as it concerns *military matters*, is a holy hymn ſung in thankſgiving for any victory obtained, and which is ſometimes abuſed, by being ſung by the vanquiſhed enemy, to conceal their ſhame, &c.

TENABLE, in the *military art*, ſomething that may be defended, kept, and held againſt aſſailants.

Tenable, is little uſed, but with a negative. When a place is open on all ſides, and its defences all beaten down, it is no longer tenable. When the enemy has gained ſuch a height, this poſt is not tenable.

TENAILLES, in *fortification*, are low works made in the ditch before the curtains: there are three ſorts, viz. the firſt are the faces of the baſtions produced, till they meet, but much lower; the ſecond have faces, flanks, and a curtain; and the third have only faces and flanks.

Single Tenaille, is a work whoſe front is advanced towards the country, having two faces, forming a re-entering angle: its two long ſides terminate on the counterſcarp, oppoſite to the angle of the ſhoulder.

Double Tenaille, is a work, whoſe front having 4 faces, forms 2 re-entering, and 3 ſalient angles: its long ſides are likewiſe parallel, and terminate on the counterſcarp, oppoſite to the angle of the ſhoulder. Both the ſingle and double tenailles have this fault, viz. that they are not flanked or defended at the re-entering angle, becauſe the height of the parapet hinders the ſoldiers from diſcovering before that angle. Therefore tenailles ſhould only be made, when there is not room enough to make horn-works. The ramparts, parapets, ditches, covert-way, and glacis of tenailles, are the ſame with other out-works.

Tenaille *of a place*, is what is comprehended between the points of two neighbouring baſtions; as the faces, flanks, and curtain. Hence it is ſaid, the enemy attacked the whole tenaille of a place, when they make two attacks on the faces of the two baſtions.

TENAILLONS, are works made on each ſide of the ravelin, much like the lunettes: they differ, in that one of the faces of a tenaillon is in the direction of the face of the ravelin; whereas that of the lunette is perpendicular to it.

TENTS, in *war*, a pavillion or portable houſe. They are made of canvaſs, for officers and ſoldiers to lie under when in the field.

The ſizes of the officers tents are not fixed; ſome regiments have them of one ſize, and ſome of another: a captain's tent and marquée is generally 10½ feet broad, 14 deep, and 8 high: the ſubalterns are a foot leſs; the major's and lieutenant-colonel's, a foot larger; and the colonel's 2 feet larger.

The ſubalterns of foot lie two in a tent, and thoſe of horſe but one.

The tents of private men are 6½ feet ſquare and 5 feet high, and hold 5 ſoldiers each.

The tents for the horſe are 7 feet broad and 9 feet deep: they hold likewiſe 5 men, and their horſe accoutrements.

Bell-Tents, ſo called from their reſemblance to a bell: they ſerve to ſhelter the fire-arms from rain.

To pitch the Tents, is to fix them up ready for habitation, by the aſſiſtance of a ridge-pole, two ſtandards, and a quantity of tent-pins.

TERRASS. See Mortar.

TERRE *plein*, in *fortification*, the top platform, or horizontal ſurface of the rampart, whereon the cannon are placed, as well as the troops that defend the place: it is alſo the paſſage of the rounds.

TERTIATE, in *gunnery*, is to examine the thickneſs of the metal of a piece of artillery, in order to judge of its ſtrength. This is uſually done with a pair of calliper compaſſes.

TERTIATING *a piece of ordnance*, is to find whether it has its due thickneſs at the vent, trunnions, and neck; if the trunnions and neck are in their due order, and the chaſe ſtraight, &c.

TESTUDO, in the *military art of the ancients*, was a kind of cover or ſcreen, which the ſoldiers of each company made themſelves of their bucklers, by holding them up over their heads, and ſtanding cloſe to each other. This expedient ſerved to ſhelter them from darts, ſtones, &c. thrown upon them, eſpecially thoſe from above, when they went to the aſſault.

Testudo, was alſo a kind of large wooden tower, which moved on ſeveral wheels, and was covered with bullocks hides: it ſerved to ſhelter the ſoldiers, when they approached the walls to mine them, or to batter them with rams.

TEUTONIC *order*. See Order.

THEORY, in *general*, denotes every doctrine which terminates in ſpeculation alone, without conſidering the practical uſes and application thereof. Military theory and practice joined are exceedingly uſeful.

THUNDERING-*legion*, was a legion in the Roman army, conſiſting of Chriſtian ſoldiers; who, in the expedition of the emperor Marcus Aurelius againſt the Sarmatæ, Quadi, and Marcomanni, ſaved the whole army, then ready to periſh of thirſt, by procuring, by their prayers, a very plentiful ſhower thereon, and at the ſame time a furious ſtorm of hail, mixed with lightening and thunderbolts, on the enemy.

This is the account commonly given by eccleſiaſtical hiſtorians, and the whole hiſtory is engraven in baſs-relievos on the Antonine column.

TILTS. See Tournaments.

TIMBER, in *military architecture*, includes all kinds of felled and ſeaſoned wood uſed in the ſeveral parts of building, &c.

Oak, of all the different kinds of timber known in Europe for building, is the beſt in all reſpects; becauſe, when it is well ſeaſoned and dry, it is very tough and hard: it does not ſplit ſo eaſy as other timber, and bears a much greater weight than any other. When it is uſed under cover, it never periſhes, no more than in water; on the contrary, the older it grows, the harder it becomes; and when it is expoſed to the weather, it exceeds all other timber for durableneſs. Engliſh oak is the beſt, American the next, then Norway, and laſtly German.

Elm, if felled between November and February, is all ſpine or heart, and no ſap, and is of ſingular uſe in places where it is always wet or dry. It is very tough and pliable; it is eaſily worked, and does not eaſily ſplit: it bears driving of bolts and nails into it better than any other wood; for which reaſon it is almoſt the only kind of wood uſed in artillery.

Beach, is likewiſe a very uſeful wood; it is very tough and white when young, and of great ſtrength, but liable to warp very much when expoſed to the weather, and to be worm-eaten when uſed within doors. It is frequently uſed for axle-trees, fellies, and all kind of wheel-wright work: but where it is kept conſtantly wet, and free from air, it will out-laſt oak.

Aſh. Its uſe is almoſt univerſal, but it is rather ſcarce in moſt parts of Europe: it ſerves in buildings, or for any other uſes where it is ſkreened from the weather: hand-ſpikes and oars are chiefly made of it; and indeed it is the only wood that is fit for this, or any other purpoſe, which requires the wood to be tough and pliable.

Fir, commonly known by the name of *deal*, is of late much uſed in building, eſpecially within doors. It wants but little ſeaſoning, and is much ſtronger while the reſinous particles are not exhauſted, than when it is very dry: it will laſt long under water; and indeed ſome ſay it never periſhes there.

Cheſnut-tree, eſpecially wild cheſnut, is by many eſteemed to be as good as oak, but is exceedingly rare.

There are many other kinds of wood, but not generally uſed in military works, conſequently not mentioned here.

Preſerving of TIMBER. When boards, &c. are dried, ſeaſoned, and fixed in their places, care is to be taken to defend and preſerve them; to which the ſmearing them with linſeed oil, tar, or the like oleaginous matter, contributes much.

The Dutch preſerve their gates, port-cullices, draw-bridges, ſluices, &c. by coating them over with a mixture of pitch and tar, whereon they ſtrew ſmall pieces of cockle and other ſhells, beaten almoſt to powder, and mixed with ſea-ſand, which incruſts and arms it wonderfully againſt aſſaults of wind and weather.

Seaſoning of TIMBER. As ſoon as felled, it ſhould be laid in ſome dry, airy place, but out of reach of too much wind or ſun, even which, in exceſs, will ſubject it to crack and fly. It is not to be ſet upright, but laid along, one tree upon another, only with ſome ſhort blocks between, to give it the better airing, and prevent it becoming mouldy, which will rot the ſurface and produce muſhrooms on it. Some perſons daub the trees all over with cow-dung, which occaſions their drying equally, and prevents their cracking, as they are otherwiſe very apt to do.

Some recommend the burying timber in the earth, as the beſt method of ſeaſoning it; and others have found it a fine preſervative to bury their timber under the wheat in their granaries; but this cannot be made a general practice. In Norway, they ſeaſon their deal planks, by laying them in ſalt water for 3 or 4 days, when new ſawed, and then drying them in the ſun: this is found a great advantage to them; but neither this, nor any thing elſe, can prevent their ſhrinking.

The ſeaſoning timber is the beſt way of all, for piles and other pieces that are to ſtand under the earth, or water. The Venetians firſt found out this method; and the way they do it is this: they put the piece to be ſeaſoned in a ſtrong and violent flame, turning it continually round by means of an engine, taking it out when it is every where covered with a black coaly cruſt: by this means the internal part of the wood is ſo hardened, that neither earth nor water can damage it for a long time after.

TIME, in *fencing*. There are three kinds of time, that of the ſword, that of the foot, and that of the whole body. All the times that are perceived out of their meaſure, are only to be conſidered as appeals, or feints, to deceive and amuſe the enemy.

TIME, in manœuvring, is that neceſſary interval betwixt each motion in the manual exerciſe, as well as in every movement the army or any body of men make.

TIN *tubes*. See TUBES, and LABORATORY.

TIRAILLEURS, in *the art of war*, are a kind of ſkirmiſhers, or markſmen, advanced in front to annoy the enemy, and draw off their attention; or they are left behind to amuſe and ſtop their progreſs in the purſuit.

TIRE, are great guns, ſhot, ſhells, &c. placed in a regular form. See PILES.

TOMPION. See TAMPION.

TOISE, in *military menſuration*, is a French meaſure, containing 6 of their feet, or a fathom: a ſquare toiſe is 36 ſquare feet, and a cubical toiſe is 216 feet.

Theſe two meaſures correſpond in the diviſion of the feet; but theſe diviſions being unequal, it is neceſſary to obſerve, that the proportion of the yard, as fixed by the Royal Society at London, to the ½ toiſe as fixed by the royal academy at Paris, is as 36 to 38.355.

TONGS, *of a waggon*, a piece of wood fixed between the middle of the hind ends of the ſhafts, mortiſed into the fore croſs-bar, and let into the hind croſs-bar.

TOOLS, uſed in *war*, are of many denominations and uſes, as laboratory tools, mining tools, artificers tools, &c. which words ſee.

TOPOGRAPHY, in *military hiſtory*, a deſcription or draught of ſome particular place, or ſmall tract of land, as that of a fortification, city, manor or tenement, garden, houſe, caſtle, fort, or the like; ſuch as engineers ſet out in their drawings, for the information of their prince or general.

TOURNAMENTS, or *Turnaments*, in *military antiquity*, a kind of martial ſport, or exerciſe, which the ancient cavaliers uſed to perform, to ſhow their bravery and addreſs.

Tournaments had their origin from the ancient gladiatory combats, and not from the uſage of the northerly people, as is commonly believed. In Cicero's time they were called by the Greek name *Anabatis*, becauſe their helmet, in a great meaſure, obſtructed their ſeeing.

TOWER *baſtions*, in *fortification*, are ſmall towers, made in the form of baſtions, by M. Vauban, in his ſecond and third method; with rooms or cellars underneath, to place men and guns in them.

Moveable TOWERS, in *ancient military hiſtory*, were three ſtory high, built with large beams. Each tower was placed on 4 wheels or trucks, and towards the town covered with boiled leather, to guard it from fire, and to reſiſt the darts: on each ſtory 100 archers were poſted. They were puſhed by the force of men to the city wall. From theſe the ſoldiers, placed in the different ſtages, made ſuch vigorous diſcharges, that none of the garriſon dared to ſhow themſelves on the rampart.

TOWN-*adjutant*, is an aſſiſtant to the town-major. See ADJUTANT.

TOWN-*major*, is an officer conſtantly employed about the governor or officer commanding a garriſon, &c. He iſſues their orders to the troops, and reads its common orders to freſh troops when they arrive. He commands according to the rank he had in the army; but if he never had any other commiſſion than that of town or fort-major, he is to command as youngeſt captain. See MAJOR.

TRAIL, in *gunnery*, is the end of a travelling-carriage, oppoſite to the wheels, and upon which the carriage ſlides, when unlimbered, or upon the battery. See CARRIAGE.

TRAIN, in *war*, the attendance of a prince, or general, upon many occaſions.

TRAIN, is alſo uſed for a line of gun-powder, laid to give fire to a quantity thereof, in order to do execution by blowing up earth, works, buildings, &c.

TRAIN *of artillery*, in a *general ſenſe*, means the regiment of artillery; it alſo includes the great guns, and other pieces of ordnance belonging to an army in the field. See ARTILLERY.

TRAIN-*bands*, or *trained-bands*, a name given to the militia of England.

TRANSOMS, in *artillery*, are pieces of wood which join the cheeks of gun-carriages: there is but one in a truck-carriage, placed under the trunnion-holes; and four in the wheel-carriages, the trail, the centre, the bed, and the breaſt-tranſoms. See CARRIAGE.

TRANSOM-*plates*, with hooks. There is one on each ſide of the ſide-pieces, againſt each end of the tranſom, the bed-tranſom excepted, faſtened by two tranſom-bolts. See IRON-WORK OF FIELD CARRIAGES.

TRANSOM-*bolt*, with bars. They ſerve to tie the ſide-pieces to the tranſoms. See IRON-WORK OF FIELD CARRIAGES.

TRAVELLING { *carriages.* See CARRIAGE.
{ *forge.* See FORGE.

TRAVERSE, in *fortification*, is a parapet made croſs the covert-way, oppoſite to the ſalient angles of the works, and near the places of arms, to prevent enfilades. They are 18 feet thick, and as high as the ridge of the glacis. There are alſo traverſes made in the caponiers; but then they are called *tambours*.

TRAVERSES, are likewiſe made within other works, when there are many hills and riſing grounds which may ſee the inſide of theſe works. They are alſo made in the ſaps, &c. See FORTIFICATION.

To TRAVERSE *a gun or mortar*, is to bring her about to the right or left with hand-ſpikes, 'till ſhe is pointed exactly to the object.

TRAVERSING-*plates*, in *gun-carriages*, are two thin iron plates, nailed on the hind part of a truck carriage of guns, where the hand-ſpike is uſed to traverſe the gun. See CARRIAGE.

TREMOINS, a term for pieces of earth left ſtanding, as marks, in the ditches of a fortification they are emptying, to know exactly how many cubical fathoms, or feet of earth, have been carried away; and thereby the workmen are paid.

TRENCHES, in a *ſiege*, are ditches made by the beſiegers, that they may approach more ſecurely to the place attacked; whence they are alſo called *lines of approach*. The tail of the trench is the place where it was begun, and its head is the place where it ends.

The *trenches* are uſually opened or begun in the night-time; ſometimes within muſket-ſhot, and ſometimes within half or whole cannon-ſhot, of the place; generally about 800 toiſes. They are carried on in winding lines, nearly parallel to the works, ſo as not to be in view of the enemy, nor expoſed to the enemy's ſhot.

The workmen employed in the *tren*[illegible] are always ſupported by a number of troop fend them againſt the ſallies of the beſieged. The pioneers, and other workmen, ſometimes work on their knees, and are uſually covered with mantlets or ſauciſſons; and the troops who ſupport them lie flat on their faces, in order to avoid the enemy's ſhot. On the angles or ſides of the trench, there are lodgements, or epaulements, in form of traverſes, the better to hinder the ſallies of the garriſon, and to favour the advancement of the trenches, and to ſuſtain the workmen.

The platforms for the batteries are made behind the trenches; the firſt at a good diſtance, to be uſed only againſt the ſallies of the garriſon. As the approaches advance, the batteries are brought nearer, to ruin the defences of the place, and diſmount the artillery of the beſieged. The breach batteries are made when the trenches are advanced near the covert-way.

If two attacks, there muſt be lines of communication, or boyaus, between the two, with places of arms at convenient diſtances. The trenches are 6 or 7 feet high with the parapet, which is 5 feet thick, with banquettes for the ſoldiers to mount upon.

Returns of a TRENCH, are the elbows and turnings, which form the lines of approach, and made, as near as can be, parallel to the place, to prevent their being enfiladed.

To mount the TRENCHES, is to mount guard in the trenches, which is generally done in the night.

To relieve the TRENCHES, is to relieve the guard of the trenches.

To ſccur the TRENCHES, is to make a vigorous ſally upon the guard of the trenches, force them to give way, and quit their ground, drive away the workmen, break down the parapet, fill up the trench, and nail their cannon.

Counter-TRENCHES, are trenches made againſt the beſiegers; which conſequently have their parapet turned againſt the enemy's approaches, and are enfiladed from ſeveral parts of the place, on purpoſe to render them uſeleſs to the enemy, if they ſhould chance to become maſters of them; but they ſhould not be enfiladed, or commanded by any height in the enemy's poſſeſſion.

To open the TRENCHES, is the firſt breaking of ground by the beſiegers, to carry on their approaches towards the place. See SIEGE.

TRIANGLE, in *geometry*, is a figure of three ſides, and three angles, and either plane or ſpherical.

Plane TRIANGLE, is that contained under three right lines.

Right-angled TRIANGLE, is that which hath one right angle.

Obtuſe-angled TRIANGLE, is ſuch as hath one obtuſe angle.

Acute-angled TRIANGLE, is that which hath all its angles acute.

Equilateral TRIANGLE, is that which hath all its ſides equal to one another, as likewiſe its angles equal to 60 degrees each.

Iſoſceles TRIANGLE, is that which hath only two ſides equal.

Scalenous TRIANGLE, is that which hath no two ſides equal. In every triangle, the ſum of all the three angles is equal to two right ones; and the external angle, made by any ſide produced, is equal to the ſum of the internal and its oppoſite one.

In every triangle, as well plane as ſpherical, the ſines of the ſides are proportional to the ſines of the oppoſite angles.

TRIARII, in the *Roman militia*, a kind of infantry, armed with a pike, a ſhield, a helmet, and a cuiraſs; thus called, becauſe they made the third line of the battle.

TRIBUNE, an officer in the Roman army, who commanded in chief over a body of forces, particularly the diviſion of a legion, much the ſame with our colonel, or the French *maître-de-camp*.

TRIUMPH, a ſolemnity practiſed by the ancient Romans, to do honour to a victorious general.

There were two ſorts of *triumphs*, the greater and the leſſer, particularly called *ovation*: of theſe, the *triumph* was by much the more ſplendid proceſſion. None were capable of this honour but the dictator, conſuls, and prætors; though there are examples to the contrary, as particularly in Pompey the Great, who had a *triumph* decreed him when he was only a Roman knight, and had not yet reached the ſenatorial age.

The *triumph* was the moſt pompous ſhow among the ancients: authors uſually attribute its invention to Bacchus, and tell us, that he firſt triumphed upon the conqueſt of the Indies; and yet this ceremony was only in uſe among the Romans. The Grecians had a cuſtom which reſembled the Roman *triumph*; for the conquerors uſed to make a proceſſion through the middle of their city, crowned with garlands, repeating hymns and ſongs, and brandiſhing their ſpears: their captives were alſo led by them, and all their ſpoils expoſed to public view. The order of a Roman *triumph* was chiefly thus: The ſenate having decreed the general a *triumph*, and appointed a day, they went out of the city gate to meet the conqueror, and marched in order with him through the city. The cavalcade was led up by the muſicians, who had crowns on their heads; and after them came ſeveral chariots with plans and maps of the cities and countries ſubdued, done in relievo: they were followed by the ſpoils taken from the enemy, their horſes, arms, gold, ſilver, machines, tents, &c. After theſe came the kings, princes, or generals ſubdued, loaden with chains, and followed by mimics or buffoons, who exulted over their misfortunes. Next came the officers of the conquering troops, with crowns on their heads. Then appeared the triumphal chariot, in which was the conqueror richly clad in a purple robe, embroidered with gold, ſetting forth his glorious atchievements. His buſkins were beſet with pearl; and he wore a crown, which at firſt was only laurel, but afterwards gold: one hand held a laurel-branch, the other a truncheon. At his feet were his children, or ſometimes on the chariot-horſes. As the triumphal chariot paſſed along, they ſtrewed flowers before it. The muſic played in praiſe of the conqueror, amidſt the loud acclamations of the people, crying, *To triumph!* The chariot was followed by the ſenate, clad in white robes, and the ſenate by ſuch citizens as had been ſet at liberty, or ranſomed. The proceſſion was cloſed by the ſacrifices, and their officers and utenſils, with a white ox led along for the chief victim. In the mean time all the temples were open, and altars loaded with offerings and incenſe; games and combats were celebrated in the public places, and rejoicings appeared every where.

TROOP *of horſe*, or *dragoons*, is a ſmall body of about 50 or 60, commanded by a captain, captain-lieutenant, cornet, quarter-maſter, and 3 or 4 corporals, who are the loweſt officers in a troop.

TROOPER, a private man in a troop of horſe.

Troop, a certain beat of the drum. See Drum.

TROPHY, among the ancients, a pile or heap of arms of a vanquiſhed enemy, raiſed by the conqueror in the moſt eminent part of the field of battle.

The *trophies* were uſually dedicated to ſome of the Gods, eſpecially Jupiter. The name of the deity, to whom they were inſcribed, was generally mentioned, as was that alſo of the conqueror. The ſpoils were at firſt hung upon the trunk of a tree; but inſtead of trees, ſucceeding ages erected pillars of ſtone, or braſs, to continue the memory of their victories. To demoliſh a *trophy* was looked upon as a ſacrilege, becauſe they were all conſecrated to ſome deity.

Trophy-*money*, denotes certain money annually raiſed in the ſeveral counties of the kingdom, towards providing harneſs, and maintaining the militia.

TROUS-DE-LOUP, in *field fortification*, are round holes, about 6 feet deep, and pointed at the bottom, with a ſtake placed in the middle. They are frequently dug round a redout, to obſtruct the enemy's approach. They are circular at top, of about 4½ feet diameter.

TRUCE, in the *art of war*, denotes a ſuſpenſion of arms, or a ceſſation of hoſtilities, between two armies, in order to ſettle articles of peace, bury the dead, or the like.

TRUCKS *of a ſhip-carriage*, are wheels made of one piece of wood, from 12 to 19 inches diameter, and their thickneſs is always equal to the caliber of the gun.

The Trucks *of garriſon-carriages* are made of caſt-iron.

Truck-*carriage*, goes upon 4 trucks of 24 inches diameter, has two flat ſide-pieces, of 10 inches broad, and ſerves to carry guns, ammunition-boxes, or any other weights, from the ſtore-houſes to the water ſide, or to any ſmall diſtance.

TRUMPET, made of braſs or ſilver, with a mouth-piece to take out and put in at pleaſure. Each troop of cavalry has one.

The firſt ſound of a trumpet before a march, is when the drums beat a *general*, at which the troopers boot, ſaddle, and get ready. When the *aſſembly* begins to beat, the trumpet ſounds *to horſe*; on which the troopers mount, and, at the third ſound, march. The trumpet likewiſe ſounds a charge in the day of battle, and the retreat at night, &c. The cords of the trumpets are of crimſon, mixed with the colours of the facings of the regiments. The king's own regiment of dragoons, and the royal Iriſh, are permitted to continue their kettle-drums; to which they are to have banners of the ſame dimenſions as thoſe which are ordered for the regiments of horſe.

TRUNCHEON, in *military affairs*, a ſtaff of command, borne by a general officer. It likewiſe implies a club, or cudgel.

TRUNCHEONEER, is one armed with a truncheon.

TRUNNIONS, in *guns*, two cylindric pieces of metal in a gun, mortar, or howitzer, which project the piece, and by which they are ſupported upon their carriages. See CANNON.

TRUNNION-*plates*, are two plates in travelling carriages, mortars, and howitzers, which cover the upper parts of the ſide-pieces, and go under the trunnions; its fore part ends with a flat roſe. See CARRIAGE.

TRUSS *of forage*, is as much as a trooper can carry on his horſe's crupper. See SPUN-HAY.

Dimenſions of Tin TUBES *for all the different ſorts of artillery.*

Natures	Length			Length			Diameters		
	Heavy	Mediums	Light	Sea mortars	Land mortars	Howitzers	Cap at top	Cap at bottom	Spindle
	inches	inches	inches	inches	inches	inches	inches	inches	inches
42 pdrs.	9.7						.9	.15	.2
32 ditto	9.7						.9	.15	.2
24 ditto	8.9	8.3	6.5				.9	.15	.2
18 ditto	8.						.9	.15	.2
12 ditto	7.3	7.3	5.7				.9	.15	.2
9 ditto	6.8	6.8					.9	.15	.2
6 & 4 ditto	6.5	5.7	4.7				.9	.15	.2
3 ditto	5.9		4.2				.9	.15	.2
1½ ditto	4.2						.9	.15	.2
13 in. S. M.				12.			1.2	.12	.2
10 in. S. M.				7.7½			1.	.13	.2
10 in. L. M.					5.7		1.	.13	.2
8 in. L. M.					4.7		.9	.15	.2
5½ royal cohorn					4.2		.8	.15	.2
4⅖ royal cohorn						6.5	.9	.15	.2
8 in. H.						5.7	.8	.15	.2
5½ in. H.						4.2	.8	.15	.2
4⅖ in. H.						3.6	.8	.15	.2

N. B. S. M. ſtands for *ſea-ſervice mortar*, L. M. for *land-ſervice mortar*, and H. for *howitzer*.

TUGPINS, are the iron pins which paſs through the fore ends of the ſhafts of the army carts, to faſten the draught-chains for the fore-horſes.

TUMBRELS, are a kind of carriages with two wheels only: they are uſed to carry the pioneers, miners, and artificers tools: ſometimes they are uſed to carry the money of the army.

TURNAMENT, or *tournament*, a martial ſport, or exerciſe, which the ancient cavaliers uſed to perform to ſhow their bravery and addreſs. They were firſt inſtituted in the year 934; but they made not their appearance in England 'till the reign of king Stephen, anno 1138.

TURNPIKE, in the *military art*, a kind of beam, ſtuck full of ſpikes, to be placed in a defile, breach, or at the entrance of a camp, &c. to keep off an enemy.

V U

VALOUR, in the *army*, is a generous character, which, far from aſſuming brutality and violence, with-holds the fury of the ſoldier, protects helpleſs women, innocent infants, and white old-age. No thing which is incapable of reſiſtance can ever be the object whereon true valour may exerciſe its proweſs. Courage is that grandeur of ſoul which prompts us to ſacrifice all perſonal advantages, and even the preſervation of our beings, to a love of doing our duty. The exerciſe of this determined courage in the profeſſion of arms is called *valour*. It is compoſed of bravery, reaſon, and force: by *bravery* we underſtand that lively ardour which fires us for the combat; *reaſon* points out to us the method of conducting it with juſtice and prudence; and *force* is neceſſary for the execution. It is bravery which animates the heart, reaſon ſprings from the ſoul, and force depends upon the body: without bravery we fear obſtacles, danger, and death; without reaſon courage would have no legitimate view; and without force it would be uſeleſs: theſe three qualities ſhould concur to form true military valour.

VAN, the front of an army.

VAN-*guard*, that part of the army which marches in the front. See GUARD.

VEDETTE, in *war*, a centinel on horſeback, with his horſe's head towards the place whence any danger is to be feared, and his carabine advanced, with the butt-end againſt his right thigh. When the enemy has encamped, there are vedettes poſted at all the avenues, and on all the riſing grounds, to watch for its ſecurity.

The *vedettes* to the out-poſts ſhould always be double, for the following reaſons: Firſt, that whenever they make any diſcovery, one may be detached to the commanding officer of the out-poſts; ſecondly, that they may keep each other watchful; and thirdly, that the vigilance of both may render it impoſſible for any thing to come near them without being ſeen. They ſhould be at no greater diſtance from their detachment, than 80 or 100 paces.

VELOCITY. See GUNNERY, MOTION, and PROJECTILES.

VENT, in *artillery*, or, as it is vulgarly called, the *touch-hole*, is the opening through which the fire is conveyed to the powder which compoſes the charge.

As the placing the *vents* in mortars, howitzers, and guns, in the beſt manner, is ſo very delicate a point, and about which both authors and practitioners differ, we will advance what the reſult of experiments has demonſtrated. The moſt common method is to place the *vent* about ¼ of an inch from the bottom of the chamber, or bore; though we have ſeen many ½ an inch, and ſome an inch from the bottom. It has always been imagined, that if the *vent* was to come out in the middle of the charge, the powder would be inflamed in leſs time than in any other caſe, conſequently produce the greateſt range; becauſe, if a tube be filled with powder, and lighted in the centre, the powder would be burnt in half the time it would be if lighted at one end. This gave a grounded ſuppoſition, that the greater quantity of powder burnt before the ſhot or ſhell was ſenſibly moved from its place, the greater force it would receive. To determine this, the king of Pruſſia, in 1765, ordered, that a light 3-pounder ſhould be caſt with three ſhifting *vents*, one at the centre of the charge, one at the bottom, and the other at an equal diſtance from the bottom and centre one; ſo that when one was uſed, the others were effectually ſtopped. The gun weighed 2C. 1qr. 20lb. its length was 3 feet 3 inches, and the bottom of the bore quite flat. It was loaded each time with ¼ of the ſhot's weight; when it was found, that when the loweſt or bottom *vent* was uſed, the ſhot went fartheſt, and the ranges of the others diminiſhed in proportion as they were diſtant from the bottom.

The piece was elevated to 1 degree 30 minutes. In 1766, the ſame monarch had three ſmall mortars made of equal ſize and dimenſions: their bores were 4.6 inches, and 73.5 inches long; one had a cylindric chamber of 1.6 inches diameter, and 3.7 inches long; the other a concave chamber, the entrance of which was 1 inch diameter; the third a conic chamber, whoſe greateſt diameter was 2.7 inches, and the leaſt 1.4. Each of theſe chambers held 7½ ounces of powder; they had each two vents, one at the bottom of the chamber, and the other at the centre. Each mortar weighed about 89 pounds, and the ſhell, when filled, 7 pounds; and the following experiments were tried. The ranges are in feet.

Experiments to find the proper place for VENTS, *and the beſt figure for chambers; by order of his majeſty the king of Pruſſia.*

Powd. Ounces	Elevat. °	Elevat. ′	Place of vents.	Conic cham.	Cyli. cham.	Conca. chamb.	Remarks
5	30		middle	1890	1936	2290	Com pow. Cool day
5	35	30	ditto	1974	1998	2374	ditto ditto
5	45		ditto	2892	3031	3176	ditto ditto
5	45		ditto	2746	3018	3168	ditto ditto
5	30		bottom	2218	2400	2563	ditto, warm & windy
5	35	30	ditto	2357	2590	2730	ditto ditto
5	45		ditto	2986	3147	3267	ditto ditto
5	45		ditto	2843	3139	3281	ditto ditto
7½	45		middle	3263	3521	3698	ditto, cool & calm
7½	45		ditto	3228	3524	3702	ditto ditto
7½	45		ditto	3196	3516	3708	ditto ditto
7½	43	30	ditto	3276	3602	3824	ditto, warm & calm
7½	43	30	ditto	3209	3598	3796	ditto ditto
7½	44		bottom	3198	3567	3818	ditto ditto
7½	44		ditto	3201	3603	3823	ditto ditto
7½	43		ditto	3186	3579	3784	ditto ditto
7½	43		ditto	3214	3547	3748	ditto ditto

N. B. By this table it appears, that the concave chamber produced the greateſt ranges, and that the bottom of the chamber is the beſt place for *vents*, having in that place the greateſt effect. Each range was the medium of 12 rounds.

VENT-*field*, is the part of a gun or howitz between the breech-mouldings and the aſtragal.

VENT-*aſtragal*, that part of a gun, or howitzer, which determines the vent-field.

VETERAN, in the *Roman militia*, a ſoldier who was grown old in the ſervice, or who had made a certain number of campaigns, and on that account was intitled to certain benefits and privileges.

Twenty years ſervice were ſufficient to intitle a man to the benefit of a veteran. Theſe privileges conſiſted in being abſolved from the military oath, in being exempted from all the functions of a ſoldier, in enjoying a certain ſalary or appointment, &c.

VIBRATION. See PENDULUM.

VICTORY, the overthrow or defeat of an enemy, in war, combat, duel, or the like.

VICTUALS, *or regulations for victualling the royal regiment of artillery, and other troops on board of the tranſports; with the method of claſſing the men, women, and children, into meſſes.*

As ſoon as the troops are embarked, the quarter-maſter immediately divides them into meſſes, allowing 4 or 6 to each meſs; that is, 1 man, 1 woman, and 3 children under 10 years of age, being equal to a meſs of 4 men. Children at 10 years of age are accounted men or women.

When the meſſes are completed, and every one claſſed to their births, the quarter-maſter gives the ſteward of the tranſport a return of the number thereof; upon the receipt of which he immediately iſſues out bedding and utenſils at the following rate.

To each birth, 1 flock bed, 1 bolſter, 2 blankets, and 1 rug.

To each meſs, 2 bowls, 4 ſpoons, 1 can, and 1 pudding-bag.—N. B. Three men are generally appointed to 1 birth.

The following table gives the daily allowance of proviſions of each ſpecies per man.

Days	Biſcuit	Beef	Pork	Peas	Oatmeal	Butter	Cheeſe	Beer	Vinegar
	lb.	lb.	lb.	pints	pints	oz.	oz.	gal.	pints
Sunday	1	0	1	½	0	0	0	1	0
Monday	1	0	0	0	1	2	4	1	0
Tueſday	1	2	0	0	0	0	0	1	0
Wedneſd.	1	0	0	½	1	2	4	1	0
Thurſday	1	0	1	½	0	0	0	1	0
Friday	1	0	0	½	1	2	4	1	0
Saturday	1	2	0	0	0	0	0	1	½

N. B. The weights are averdupois, and the pints Wincheſter meaſure.

When any alterations from the above take place, it is in the following manner: A pint of wine, half a pint of brandy, rum, or arrack, are equal to a gallon of beer; 4 pounds of flour, or 3 pounds of the ſame, with a pound of fruit, raiſins, or ½ a pound of currants, or ½ a pound of pickled beef ſuet, are equal to 4 pounds of beef, or 2 pounds of pork with peas; ½ a pound of rice is equal to 1 pound of oatmeal; a pint of olive oil is equal to 1 pound of butter, or 2 pounds of Suffolk cheeſe; and ⅔ of a pound of Cheſhire cheeſe, is equal to 1 pound of Suffolk cheeſe. Beef provided for his majeſty's ſhips, is to be cut into 4-pound pieces, and the pork into 2-pound pieces; and no unuſual pieces are to be put up, ſuch as legs, bones, ſhins of oxen, cheeks of hogs, ox-hearts, &c.

If it ſhould happen that the pork runs ſhort, the captain is to order the purſer to iſſue 3 pounds of beef for 2 pounds of pork.

For the better preſervation of the men's health, it is ordered that one day in the week, there ſhall be iſſued out to them a proportion of flour and ſuet in lieu of beef; alſo a proportion of canvaſs for pudding-bags, after the rate of 1 ell to every 16 men.

In foreign voyages, there ſhall only be ſupplied 3 months butter and cheeſe; the remainder of thoſe ſpecies to be made up in olive oil.

Table *of the allowance of proviſions ſerved out at the different forts, garriſons, and ports, in North America, to his majeſty's troops; they paying at the rate of 2½d. per day, or per ration.*

7 days in all ſpecies				7 days in any one ſpecies				1 day in any one ſpecies			
Species	lb.	oz.	pints	Species	lb.	oz.	pts.	Species	lb.	oz.	pts.
Flour	7			Flour	21			Flour	3		
Freſh beef	7			Pork	9	3		Pork	1	5	
Butter		6		Butter	5	4		Butter		12	
Pork in lieu of beef	4			Peas			28	Peas			4
Peas			3	Rice			10½	Rice			1½
Rice			½								

N. B. The pork, butter, peas, and rice, are in lieu of the 7 lb. of beef.

VIEW *of a place*, to beſiege it, is ſaid to be taken when the general, accompanied by an engineer, reconnoitres it; that is, rides round the place, obſerving its ſituation, with the nature of the country about it; as hills, valleys, rivers, marſhes, woods, hedges, &c. thence to judge of the moſt convenient place for opening the trenches, and carrying on the approaches; to find out proper places for encamping the army, and for the park of artillery.

To View. See *To* Reconnoitre.

VOLLEY, is a military ſalute, made by the diſcharging of a great number of fire-arms at the ſame time.

VOLUNTEERS, perſons who, of their own accord, either for the ſervice of their prince, or out of the eſteem they have for their general, ſerve in the army without being inliſted, to gain honour and preferment, by expoſing themſelves in the ſervice.

UHLANS, are Uckranian ſoldiers, chiefly Mahometans. In perſon, dreſs, and manner of fighting, they reſemble the Tartars, Calmucks, &c. They are armed with piſtols, ſabres, a lance 15 feet long, and ſometimes uſe a bow and arrow inſtead of a carbine.

UNDECAGON, is a regular polygon of 11 ſides.

UNIFORM. See Regimentals.

UTENSILS, in a *military ſenſe*, are neceſſaries due to every ſoldier, and to be furniſhed by his hoſt, where he is in quarters, viz. bed, with ſheets, a pot, a glaſs or cup to drink out of, a diſh, a place at the fire, and a candle. See Billeting.

W

WAD, in *gunnery*, made of hay or ſtraw, and ſometimes of tow rolled up tight in a ball, ſerves to be put into a gun after the powder, and rammed home, to prevent the powder from being ſcattered, which would have no effect when unconfined.

WAD-*mill*, a hollow form of wood to make the wads of a proper ſize.

WAD-*hook*, a ſtrong iron ſcrew, like thoſe that ſerve for drawing corks, mounted upon a wooden handle, to draw out the wad, or any parts of cartridges, which often remain in guns, and when accumulated ſtop up the vent.

WADDING, hay or ſtraw, or any other forage, generally carried along with the guns to be made into wads.

WAGGON, in *the army*, is a four-wheel carriage, drawn by 4 horſes, and for ſundry uſes.

Ammunition-WAGGON, is for tranſporting all kinds of ſtores, as alſo to carry bread, it being lined round in the inſide with baſket-work.

WARNING-*piece*. See EVENING-GUN, at the word GUN.

WAR, a conteſt or difference between princes, ſtates, or large bodies of people, which, not being determinable by the ordinary meaſures of juſtice and equity, is referred to the deciſion of the ſword.

It is that important event for which all military education is deſigned to prepare the ſoldier. It is for this that in peace he receives the indulgence of a ſubſiſtence from ſociety; and for this he is gratefully bound to ſecure the repoſe of that ſociety from the outrage of barbarians, and to guard its poſſeſſions from the devaſtations of banditti.

Though it would be equally needleſs, as impoſſible, to ſhow how often this art of the ſoldier has accompliſhed the deſign of its inſtitution; we ſhall however diſtinguiſh thoſe wars which are remarkable for having obtained the bleſſings of peace to this kingdom ſince the

- War with Scotland, 1068.
- Peace with
  - ditto, 1113.
  - France, 1113.
- War with France, 1116.
- Peace with
  - ditto, 1118.
  - Scotland, 1139.
- War with France, 1161.
- Peace with ditto, 1186.
- War again with France, with ſucceſs, 1194.
- Peace with ditto, 1195.
- Civil war
  - renewed, 1215.
  - ended, 1216.
  - with France, 1224.
  - ended, 1243.
  - 1262.
  - ended, 1267.
  - with France, 1294.
  - with Scotland, 1296.
- Peace
  - with France, 1299.
  - with Scotland, 1323.
- War
  - again with Scotland, 1327.
  - ended, 1328.
  - again with Scotland, 1333.
  - with France, 1339.
- Peace with France, May 8, 1360.
- War
  - with France, 1368.
  - civil, 1400.
  - with Scotland, 1400.
- Peace with France, May 31, 1420.
- War
  - with France, 1422.
  - civil between York and Lancaſter, 1452.
- Peace with France, Oct. 1471.
- War
  - civil, 1486.
  - with France, Oct. 6, 1492.
- Peace
  - with ditto, Nov. 3, 1492.
  - with Scotland, 1502.
- War
  - with France, Feb. 4, 1512.
  - with Scotland, 1513.
- Peace with France, Aug. 7, 1514.
- War with
  - ditto, 1522.
  - Scotland, 1522.
- Peace with
  - France, 1527.
  - Scotland, 1542.
- War with Scotland, directly after.
- Peace with France and Scotland, June 7, 1546.
- War with
  - Scotland, 1547.
  - France, 1549.
- Peace with both, March 6, 1550.
- War
  - civil, 1553.
  - with France, June 7, 1557.
  - with Scotland, 1557.
- Peace with
  - France, April 2, 1559.
  - Scotland, 1560.
- War, Peace with France
  - 1562.
  - 1564.
- War with
  - Scotland, 1570.
  - Spain, 1588.

Peace with ditto, Aug. 18, 1604.
War with { Spain, 1624.
{ France, 1627.
Peace with Spain and France, April 14, 1629.
War { civil, 1642.
{ with the Dutch, 1651.
Peace with ditto, April 5, 1654.
War with Spain, 1655.
Peace with Spain, Sept. 10, 1660.
War with { France, Jan. 26, 1666.
{ Denmark, Oct. 19, 1666.
Peace with the French, Danes, and Dutch, Aug. 24, 1667.
Peace with Spain, Feb. 13, 1668.
War with the Algerines, Sept. 6, 1669.
Peace with ditto, Nov. 19, 1671.
War with the Dutch, March, 1672.
Peace with ditto, Feb. 28, 1674.
War with France, May 7, 1689.
Peace, general, Sept. 20, 1697.
War with France, May 4, 1702.
Peace of Utrecht, Mar. 13, 1713.
War with Spain, Dec. 1718.
Peace with ditto, 1721.
War with { Spain, 1739.
{ France, March 31, 1744.
Peace with France, &c. 1748.
War with { France, 1756.
{ Spain, Jan. 4, 1762.
Peace with France and Spain, Feb. 10, 1763.

There are five different kinds of war, each of which is to be conducted differently the one from the other, viz. the *offenſive*; the *defenſive*; that between *equal powers*; the *auxiliary*, which is carried on out of our own territories, to ſuccour a prince, or ally, or to aſſiſt a weaker, whom a more powerful prince has attacked; and the *civil war*.

Offenſive War, muſt be long meditated on in private, before it breaks out: when it does, the ſucceſs will depend upon two eſſential points; that the plan be juſtly formed, and the enterpriſes conducted with order. It ſhould be well and maturely conſidered and digeſted, and with the greateſt ſecrecy, leſt, however able the prince or his council may be, ſome of the precautions neceſſary to be taken may be diſcovered. Theſe precautions are infinite both at home and abroad.

Abroad, they conſiſt in alliances, and ſecurity not to be diſturbed in the meditated expedition; foreign levies, and the buying up of warlike ammunition, as well to increaſe your own ſtores as to prevent the enemy getting it.

The precautions at home conſiſt in providing for the ſecurity of our diſtant frontiers, levying new troops, or augmenting the old ones, with as little noiſe as poſſible; furniſhing your magazines with ammunition; conſtructing carriages for artillery and proviſions; buying up horſes, which as much as poſſible ſhould be done among your neighbours, both to prevent their furniſhing the enemy, and to preſerve your own for the cavalry and the particular equipages of the officers.

Defenſive War, may be divided into three kinds. It is either a war ſuſtained by a prince ſuddenly attacked by another, ſuperior to him in troops, and in means; or a prince makes this ſort of war by choice on one ſide of his frontiers, while he carries on an offenſive war elſewhere; or it is a war become defenſive by the loſs of a battle.

A *defenſive war* which a prince, attacked by a ſuperior enemy, ſuſtains, depends entirely on the capacity of his general. His particular application ſhould be, to chuſe advantageous camps, proper to ſtop the enemy, without however being obliged to fight them; to multiply ſmall advantages; to hem in the enemy in their forages, and to oblige them to do it with great eſcorts; to attack their convoys; to render the paſſages of rivers or defiles as difficult to them as poſſible; to force them to keep together: if they want to attack a town, to throw in ſuccours before it is inveſted: in ſhort, in the beginning, his chief aim ſhould be, to acquire the enemy's reſpect by his vigilance and activity, and by forcing him to be circumſpect in his marches and manner of encampment, in order to gain time himſelf, and make the enemy loſe it. An able general, carefully purſuing theſe maxims, will give courage to his ſoldiers, and to the inhabitants of the country: he gives time to his prince, to take proper precautions to reſiſt the enemy who attacks him, and thus changes the nature of this war, always diſagreeable for him who is reduced to it.

To conduct a *defenſive war* requires more military judgement than that of an offenſive one.

A War *betwixt equal powers*, is that in which the neighbouring princes take no part, ſo long as the belligerant powers obtain no great advantage the one over the other. This ſort of war never ſhould laſt long, if you want to reap any advantages from it. As to its rules, they are intirely conformable to thoſe already given; but we may look on it as a certain maxim in this ſort of war, that the general the moſt active and penetrating will ever in the end prevail over him who poſſeſſes theſe qualities in a leſſer degree; becauſe, by his activity and penetration, he will multiply ſmall advantages, 'till at laſt they procure him a deciſive one. A general, continually attentive to procure himſelf ſmall advantages, ever obtains his end, which is to ruin the enemy's army; in which caſe he changes the nature of the war, and makes it offenſive, which ſhould ever be the chief object of his prince.

Auxiliary War, is that in which a prince ſuccours his neighbours, either in conſequence of alliances or engagements entered into with them, or ſometimes to prevent their falling under the power of an ambitious prince.

If it is in virtue of treaties, he obſerves them religiouſly, in furniſhing the number of troops preſcribed, and even offering to augment it, if required; or by making a diverſion by attacking the common enemy, or his allies.

If it is to prevent a neighbouring prince from being cruſhed by a power, who after this conqueſt may become dangerous to yourſelf, there are ſeveral meaſures to be taken for your own particular intereſt. One of the chief is, to exact from thoſe you ſuccour, the poſſeſſion of ſome place, in ſecurity, leſt they make their peace without your knowledge, or to your prejudice.

The general therefore choſen for the command of this auxiliary corps, ſhould have wiſdom, penetration, and foreſight; wiſdom, to preſerve a proper diſcipline in his corps, that the allied prince may have no cauſe to complain of him; foreſight and penetration, to prevent his troops ſuffering for want of ſubſiſtence, or being expoſed to the perils of war, but in proportion to their numbers with thoſe of the allied prince; and, finally, that nothing ſhall paſs without his knowledge, which may be prejudicial to his maſter.

Civil or inteſtine War, is that between ſubjects of the ſame realm, or between parties in the ſame ſtate. In this ſenſe, we ſay, the civil wars of the Romans deſtroyed the republic; the civil wars of Grenada ruined the power of the Moors in Spain; the civil wars in England, begun 1641, ended in the king's death.

Religious War, is war maintained in a ſtate on account of religion, one of the parties refuſing to tolerate the other.

Holy War, is that anciently maintained by leagues and croiſades, for the recovery of the Holy Land.

Civil and Religious Wars, are ever unhappy for the ſtates who ſuſtain them. Theſe ſorts of war, which the animoſity of the different parties, and fanaticiſm, always carry beyond the bounds of humanity, and the duties of ſociety, have in general no other rules but thoſe of the *offenſive* and *defenſive*. It has however always been obſerved, that *civil wars* form great men and good ſoldiers; becauſe the nobility, citizens, and labourers, being equally obliged to fight for their property and preſervation, have all an opportunity of learning the art of war.

Council of War, is an aſſembly of great officers, called by a general, or commander, to deliberate with him on enterpriſes and attempts to be made. On ſome occaſions, *council of war* is alſo underſtood of an aſſembly of officers, ſitting in judgement on delinquent ſoldiers, deſerters, coward officers, &c.

WARASDINS, a kind of Sclavonian ſoldiers, clothed like the Turks, with a ſugar-loaf bonnet inſtead of a hat. Their arms are a fuzée and piſtols; the butt end of their fuzée ſerves for a ſpade, when they have occaſion to throw up earth.

WAR-CRY, was formerly cuſtomary in the armies of moſt nations, when juſt upon the point of engaging. Sometimes they were only tumultuous ſhouts, or horrid yells, uttered with an intent to ſtrike terror into their adverſaries; ſuch as is now uſed by the Indians in America, called the *war-whoop*.

WARREN, at Woolwich, is the head-quarters for the royal artillery, the royal foundery, royal laboratory, and royal military academy; alſo famous for proofs and experiments of artillery, and great apparatus of war.

WARWOLF, in *ancient military hiſtory*, an engine for throwing ſtones, and other great maſſes.

WASHERS, a flat circular ring put on the axle-tree, between the linch-pin and ſmall end of the nave, to prevent the nave rubbing againſt the linch-pin and wearing it, as likewiſe to diminiſh the friction of the nave.

WAY *of the rounds*, in *fortification*, is a ſpace left for the paſſage of the rounds, between the rampart and the wall of a fortified town. This is not much in uſe at preſent.

WEDGE. See Coins.

WEIGHTS, in *military matters*, are thoſe in general uſe, except in artillery, where hundreds are made uſe of, each of 112 lb. quarters, each of 28lb. and pounds, which are averdupois.

The 100lb. of England, Scotland, and Ireland, are equal to

91 lb.	8 oz.	of	Amſterdam, Paris, &c.
96	8		Antwerp or Brabant;
88	0		Rouen, the viſcounty weight
106	0		Lyons, the city weight;
91	8		Paris;
90	9		Rochelle;
107	11		Toulouſe & Up. Languedoc;
113	0		Marſeilles or Provence;
81	7		Geneva;
93	5		Hamburgh;
89	7		Frankfort, &c.;
137	4		Genoa;
132	11		Leghorn;
153	11		Milan;
152	0		Venice;
154	10		Naples;
97	0		Seville, Cadiz, &c.
104	13		Portugal;
112	8		Spain;
96	5		Liege;
112	$\frac{2}{3}$		Ruſſia;
107	$\frac{1}{24}$		Sweden;
89	$\frac{1}{2}$		Denmark.

WELL, in the *military art*, a depth which the miner ſinks under ground, with branches or galleries running out from it; either to prepare a mine, or to diſcover and diſappoint the enemy's mine. See SHAFT.

WHEEL, in *artillery*. Their ſtrength is always, or ſhould be, proportional to the weight they carry: the diameters of the wheels of heavy gun-carriages are 85 inches, and thoſe for light field-pieces 52 only. See CARRIAGE.

To WHEEL, a motion that brings any body of men to front on that ſide where the flank was, which is wheeling to the right or left. If a battalion wheels to the right, the left wing moves firſt, deſcribing the 4th part of a circle about the file-leader on the right, who is the centre of the motion: if the wheeling is to the left, the contrary is performed.

WHEELINGS, are different motions made both by horſe and foot, either to the right or left, or to the right and left about, &c.

General rules for WHEELING. The circle is divided into four equal points: thence, *wheeling* to the right or left, is only a quarter of the circle; *wheeling* to the right or left about, is one half of the circle.

When you *wheel* to the right, you are to cloſe to the right, ſo near as to touch your right hand man, but without preſſing him; and to look to the left, in order to bring the rank about even.

When you *wheel* to the left, you are to cloſe to the left, and look to the right, as above directed. This rule will ſerve for all *wheeling* by ranks; as when a battalion is marching by ſubdiviſions with their rank open, then each rank *wheels* diſtinctly by itſelf, when it comes to the ground on which the ranks before it *wheeled*, but not before.

In *wheeling*, the men are to take particular care neither to open nor cloſe their ranks, and to carry their arms well.

In *wheeling*, the motion of each man is quicker or ſlower, according to the diſtance he is from the right or the left; thus, when you *wheel* to the right, each man moves quicker than his right-hand man; and, *wheeling* to the left, each man moves quicker than his left-hand man; the circle that every man *wheels* being larger, according to the diſtance he is from the hand he *wheels* to; as may be ſeen by deſcribing ſeveral circles within one another, at two feet diſtance from each, which is nearly the ſpace every man is ſuppoſed to take up.

WHEEL-*carriages*, in *artillery*, &c. The whole doctrine thereof, as it ſtands on a mathematical theory, may be reduced to the following particulars, viz.

1. WHEEL-*carriages* meet with leſs reſiſtance than any other kind of carriage.

2. The larger the wheels, the eaſier is the draught of the carriage.

3. A carriage upon four wheels of equal ſize is drawn with leſs force than with two of thoſe wheels, and two of a leſſer ſize.

4. If the load be all on the axle of the larger wheels, it will be drawn with leſs force than if laid on the axis of the leſſer wheels; contrary to the common notion of loading carriages before.

5. Carriages go with much leſs force on *friction-wheels*, than in the common way; all which we hope to explain by experiments.

The theory of wheel-carriages is as follows. Let *APGEM* (Plate XV. *fig.* 3) be a wheel, *ND* the horizontal plane on which it moves, *EF* the height of an obſtacle over which it is to be drawn: the wheel arriving at the obſtacle, and touching the top *E*, ſtands upon the point *G*, and preſſes it with its whole weight. Draw *OEK*, a tangent to the *wheel* in the point *E*, and meeting the vertical diameter *AG* produced, in *O*. Draw the radius *EC*, and *EH* perpendicular to *AG*; and *MC*, *mr*, perpendicular to *CE*, and conſequently parallel to the tangent *OK*. Laſtly, draw the radius *Cm*.

2. Since the *wheel* gravitates in the direction *CO*, let *CO* expreſs its weight, preſſing the

point G; this may be reſolved into two others, CE and OE; of which CE preſſes the top of the obſtacle, and is wholly ſuſtained by it; the other weight OE draws the wheel down in a direction parallel to the tangent OK. Now let $W = CO$ weight of the *wheel*, $R =$ radius, $H = EF$, the height of the obſtacle, and $x = OE$; then ſince $OE : CO :: HE : CE$, we have $x : W :: HE : R$, whence $x = \frac{W \times HE}{R}$; but, from the nature of the circle, $HE = \sqrt{AH \times HG} = \sqrt{AH \times EF} = \sqrt{2RH - H^2}$; therefore $x = \frac{W \times \sqrt{2HR - HH}}{R}$.

3. A force juſt equal to the weight x, and acting in oppoſition to it, that is, drawing the *wheel* upwards in the direction CM parallel to EK, will juſt be able to make the *wheel* reſt on the top of the obſtacle at E, without ſuffering any part of its weight to reſt on the horizontal plane at G.

4. Now the force muſt be increaſed if it acts in any other direction but that of CM; for let it draw the *wheel* in the direction Cm, between M and E, then the force may be reſolved into two others, Cr, and rm, of which Cr draws the *wheel* directly againſt the top of the obſtacle E, and ſo is deſtroyed by equal re-action of the point E; what therefore remains to draw it upwards in a direction parallel to OK, is mr, which is leſs than CM or Cm; and to be made equal thereto, (as it muſt be to ſupport the *wheel* on the top of the obſtacle E) it muſt be increaſed in the ratio of Cm to rm, which let be as R to S (for as radius to the ſine of the angle which the direction of the force makes with CE). But it is plain, the force rm cannot be increaſed; but the whole force CM muſt be increaſed in the ſame proportion; that is, when rm becomes $\frac{R}{S} \times rm$, CM will become

$$\frac{R}{S} \times CM = \frac{R}{S} \times \frac{W \times \sqrt{2RH - H^2}}{R} = \frac{W \times \sqrt{2RH - H^2}}{S}$$

5. In order that the *wheels* may be drawn over the obſtacle FE, it is neceſſary the direction of the force ſhould be between CE and CA; for if it were in the direction CE, it could only draw the *wheel* upon or againſt, but not over the obſtacle; and if it acted in the direction CA, it would not make it preſs againſt the obſtacle, and conſequently could not draw it over.

6. Let $F = \frac{W \times \sqrt{2RH - H^2}}{S} =$ the force ſufficient to ſuſtain the *wheel* on the top E of the obſtacle, it is evident if W, R, H, continue the ſame, $F = \frac{1}{s}$; that is, the force will always be leſs as the ſine of the angle ECm is greater, 'till $rm = CM$, when the ſaid force is leaſt of all.

7. If W and H be given, or always the ſame, then $F = \frac{\sqrt{2R - 1}}{R}$ (for here we ſuppoſe the force applied to draw in the moſt advantageous direction, viz. CM, where S become equal to R.) If therefore the radii of four *wheels* be 1, 2, 3, 4, then will $\frac{\sqrt{2R - 1}}{R}$ be $1, \frac{\sqrt{3}}{2}, \frac{\sqrt{5}}{3}, \frac{\sqrt{7}}{4}$, or as the numbers 1000, 866, 745, 661. From whence it is evident how much leſs force is neceſſary to draw a large *wheel* over any obſtacle than a leſſer one, when the weight of the *wheels* is the ſame.

8. If the height of the obſtacle H be indefinitely ſmall and given, in which caſe the tangent OK will coincide with the horizontal line ND, and the point E with the point G, very nearly; and the direction of the force be parallel to ND; then becauſe H^2 is inconſiderable we reject it, and the expreſſion for the force will be $F = \frac{W \times \sqrt{2R}}{R}$, (for H is given, and therefore not expreſſed). And if W be alſo given, the force will be $F = \frac{\sqrt{2R}}{R}$, or $F = \frac{\sqrt{R}}{R}$, becauſe 2 is a given quantity; but $\frac{\sqrt{R}}{R} = \frac{1}{\sqrt{R}}$; therefore $F = \frac{1}{\sqrt{R}}$; that is, in caſe of rough uneven ſurfaces, the force to draw the *wheel* will be inverſely as the ſquare root of the radius or diameter of the *wheel*. Thus, if three *wheels* are in diameter as 1, 4, 9, the force to draw them will be as 3, 2, 1.

9. If $H = o$, that is, if the horizontal plane on which the *wheel* moves be perfectly ſmooth or plain, then the quantity $\frac{W}{S} \sqrt{2RH - H^2} = o$; whence it appears that no force is re-

quired to move a heavy body on an horizontal plane, which is perfectly even.

10. If the height H of the obſtacle be proportional to the radius of the *wheel*; that is, if H be as R, and the force draw in a direction parallel to OK; then, becauſe $\frac{\sqrt{2RH-H^2}}{R} = \frac{\sqrt{2RR-RR}}{R} = \frac{\sqrt{R^2}}{R} = 1$, therefore $F = W$, or the force will be proportional to the weight of the *wheel*.

11. If the direction of the force be parallel to the horizontal plane; that is, if Cm be parallel ND; then, becauſe the angle mCE is (in that caſe) equal to the angle CEH, their ſines will be equal, that is, $rm = CH = R - H$; therefore the expreſſion of the force (*art.* 6.) will become $F = \frac{W \times \sqrt{2HR-H^2}}{R-H}$; and if the height be given, it will be $F = \frac{W \times \sqrt{2R-1}}{R-1}$.

12. From the expreſſion $F = \frac{W \times \sqrt{2RH-H^2}}{S}$, we have this equation $\frac{F}{w} = \frac{\sqrt{2HR-H^2}}{S}$, which gives the following analogy $F:W::\sqrt{2HR-H^2}:S$; that is, the force is to the weight as the ſine of the angle ECH (viz. EH) is to the ſine of the angle mCE, which the line of direction makes with the line EC.

13. If the obſtacle is capable of being depreſſed, or born down by the *wheel*, the larger the *wheel* the greater will be the force to do this; for ſince CE repreſents the whole force with which the *wheel* bears upon the obſtacle, and this is reſolvable into the two parts CH and HE, of which the former CH being parallel to EF, tends to preſs it down, it will be expreſſed by $R-H$; and ſince H is given, the depreſſing force will be as $R-1$, and therefore will increaſe with R, or the radius of the *wheel*.

14. If the obſtacle be ſuch, as that it can neither be ſurmounted nor depreſſed, but muſt be driven forward, the force to do that will be expreſſed by $HE = \sqrt{2RH-H^2}$, which, ſince H is given, will be as $\sqrt{R-1}$; but $\sqrt{R-1}$ will be greater in proportion to the R when R is ſmall, than when it is greater. Thus, if $R = 2$, then $\sqrt{R-1} = 1 = \frac{1}{2}R$; but if $R = 5$, then $\sqrt{R-1} = 2$, which is leſs than $\frac{1}{2}R$; and if $R = 10$, then $\sqrt{R-1} = 3$, which is leſs than $\frac{1}{3}R$; ſo that in this reſpect ſmall *wheels* have the advantage of large ones: but this caſe ſeldom happens.

15. The principal advantage of ſmall *wheels* is, that in them the line of traction is not parallel to the horizon as CK (*fig.* 4.) but inclined thereto in a certain angle as CM, making with the horizon the angle MCK; now if CM be parallel to the tangent OK, the whole force will be employed to draw the *wheel* over the obſtacle EF; whereas, if the line of traction were parallel to the horizon, the line CK might expreſs the force, which being reſolved into the two forces CE and KE, ſhows that the part CE draws the *wheel* directly upon the obſtacle, and is therefore loſt by its reaction; and only the part KE remains to draw the *wheel* over the ſaid obſtacle; and conſequently the horizontal direction is not the beſt, unleſs upon a ſmooth and even ſurface, where no obſtacles and aſcents are to be ſurmounted.

16. From what has been ſaid, it is evident that a ſmall *wheel*, whoſe radius is KE, and the line of traction parallel to OK, is equivalent to a large *wheel* whoſe radius is CK, and the line of traction parallel to the horizon ND; but $EK:CK::HB:CB::CI:CE$; that is, the radius of the ſmaller *wheel* is to that of the larger, as the co-ſine of the angle ECG to radius.

17. Though the force employed be never wholly ſpent in drawing, but when the direction is CN, (*fig.* 5.) parallel to the plane on which the *carriage* moves; yet if it be applied in that oblique direction CM, where the breaſt of the horſe is higher than the axle of the *wheel* C, in which caſe only the part BM is employed in drawing, the other part CB is not however wholly loſt, but is acting contrary to the gravity of the *carriage*, and by that means leſſens ſomewhat of the weight of the load, by lifting it (as it were) along; for in this caſe the horſe not only draws, but alſo carries along (in ſome meaſure) the load.

18. On the contrary, if the axle of the wheel be higher from the plane than the breaſt of the horſe, that is, if the power be applied in the oblique direction CO, then the part DO draws the load along; but the part CD acting perpendicular on G, draws the load directly againſt the plane, and therefore increaſes the weight of the load, or the difficulty in drawing it; and is therefore the worſt direction in which the force can be any how applied in drawing. Hence it follows, that (*cæteris paribus*) where the *wheels* of a carriage have their radius equal

to the height of the horſe's breaſt, or traces, the draught will be eaſieſt of all; and *wheels*, whoſe radii are leſs than that, are better than thoſe *wheels* whoſe radii exceed it.

19. A ſmall *wheel*, *BDC* (*fig.* 6.) will deſcend farther down between two obſtacles *DF* and *CE*, than a larger *wheel ADC*, as is evident from the figure; and therefore the draught is more difficult, and ſubject to more ſhocks or jolts, with the ſmall *wheel*, inaſmuch as its axis, and conſequently the weight of the load, muſt be raiſed to a greater height in order to get from between them.

20. Alſo in ſoft or yielding ground, a ſmall *wheel* will ſink deeper than a larger *wheel* charged with the ſame weight. Thus ſuppoſe *ABC* (*fig.* 7.) be the plane of the road, which is ſo ſoft as to permit the ſmall *wheel* to ſink down to *E*, then the weight muſt overcome the reſiſtance of as much earth as the *wheel* in ſinking has diſplaced; that is, as much as is equal to the ſegment *HED*: if now the larger *wheel* were to ſink to the ſame depth, it muſt overcome the reſiſtance of ſo much earth as is equal to the ſegment *AEC*, which is greater than *HED*; which is impoſſible, becauſe the ſame weight can overcome but an equal reſiſtance in either *wheel*; therefore the larger wheel will not ſink ſo deep as the ſmaller, conſequently will be drawn more eaſily.

21. Since the ends of the axles, and the holes in the naves of large and ſmall *wheels* are equal, and ſince in paſſing along, the ſmall *wheel* (to meaſure the length of the road) muſt turn round upon its axis oftener than a large one; it follows, that there will be a greater quantity of friction in the ſmall *wheel* than in the larger, and that in the ſame proportion as it is leſs, or as its velocity is greater. Hence on account of this, and ſeveral other like cauſes, ſmall *wheels* are much more ſubject to be out of repair, to be at fault, and to be worn quite out, than larger ones.

22. Next to the conveniency mentioned, *art.* 14, that of turning the carriage in a ſmaller compaſs, with ſmall *wheels*, than can be done by large ones, has made them more neceſſary in waggons and coaches; for, becauſe of their ſmallneſs, they can be brought near to, and partly under, the ſides of the carriage, and ſo their axes lying more obliquely under the bed of the carriage, admit it to be turned about with greater eaſe; but this ſhould have no effect on carriages uſed in the artillery.

WICKET, a ſmall door in the gate of a fortified place, through which people go in and out, without opening the great gate.

WINDAGE *of a gun, mortar, or howitzer*; the difference between the diameter of the bore, and the diameter of the ſhot or ſhell. In England the diameter of the ſhot is ſuppoſed to be divided into 20 equal parts, and the diameter of the bore into 21 of thoſe parts. The French divide the ſhot into 26, and the bore into 27. The Pruſſians divide the ſhot into 24, and the bore into 25. The Dutch nearly the ſame as the Engliſh. The general windage of ſhells in England is ¼ of an inch, let them be large or ſmall, which is contrary to all reaſon. It is evident, that the leſs windage a ſhot or ſhell has, the farther and truer it will go; and having leſs room to bounce from ſide to ſide, the gun will not be ſpoiled ſo ſoon.

It is true that ſome artillery officers ſay, that the windage of a gun ſhould be equal to the thickneſs of the ladle; becauſe, when it has been loaded for a while, the ſhot will not come out, without being looſened thereby, in order to unload it; and when this cannot be done, it muſt be fired away, and ſo loſt: but in my humble opinion the moſt advantageous windage ſhould be in dividing the ſhot into 24 equal parts, and the bore into 25, on account of the convenient ſcale it affords, not only to conſtruct guns thereby, but alſo their carriages. Hence, agreeable to this plan, the windage of a 9-pounder will be .166 of an inch, conſequently a ſufficient thickneſs for a ladle; and thoſe of a higher calibre become ſtill thicker in proportion: but ſuppoſe this thickneſs is not enough, the loſs of a ſhot is a mere trifle, in reſpect to the advantage got thereby.

WIND-*gun*. See AIR-GUN.

WINDLACE, is a roller of wood, ſquare at each end, through which are either croſs holes for hand-ſpikes, or ſtaves acroſs to turn it round: by this means it draws a cord, one end of which is faſtened to ſome weight which it raiſes up. They are uſed in gins, and about Dutch mortars, to help to elevate them.

WINGS *of an army*, when drawn up in battle, are the right and left hand files; when a battalion is drawn up, the diviſions on the right and left are called the wings. The word *wing* is ſometimes uſed to denote the large ſides of horn-works, crown-works, tenailles, and the like outworks, &c.

WINTER-*quarters*. See QUARTERS.

WOLF-*holes*, in the defence of places, are round holes, generally about 2 or 3 feet in diameter at the top, 1 at bottom, and 2½ deep, dug in the front of any work. Sometimes a ſharp-pointed ſtake or two are fixed at the bottom, and covered with very thin planks, and green ſods; conſequently the enemy, on advancing, fall in, and are put into confuſion.

WORD, or *Watch-word*. See PAROLE.

WORDS *of command*, are the terms uſed by officers in exerciſing battalions or ſquadrons, or when they are in action.

WORDS *of command uſed at the manual exerciſe, as ordered by* HIS MAJESTY, *viz.*

No.	Words of command	Motions	EXPLANATIONS.
1	*Poiſe your firelock!*	2	1ſt. Seize the firelock with your right hand, and turn the lock outwards, keping the firelock perpendicular. 2d. Bring up the firelock with a quick motion from the ſhoulder, and ſeize it with the left hand, juſt above the lock, ſo that the fingers may lie upon the ſtock, with the elbows down, and the thumb to lie upon the ſtock: the firelock muſt not be held too far from the body, and the left hand muſt be of an equal height with the eyes.
2	*Cock your firelock!*	2	1ſt. Turn the barrel oppoſite to your face, and place your thumb upon the cock, raiſing your elbow ſquare at this motion. 2d. Cock your firelock, by drawing your elbow down, placing your right thumb upon the breech-pin and the fingers under the guard.
3	*Preſent!*	1	Step back about 6 inches to the rear with the right foot, bringing the left toe to the front; at the ſame time the butt-end of the firelock muſt be brought to an equal height with the ſhoulder, placing the left hand on the ſwell, and the fore-fingers of the right-hand before the trigger, ſinking the muzzle a little.
4	*Fire!*	1	Pull the trigger briſkly, and immediately after bringing up the right foot to the inſide of the left, come to the priming poſition, with the lock oppoſite to the right breaſt, the muzzle the height of the hat, keeping it firm and ſteady, and at the ſame time ſeize the cock with the fore-finger and thumb of the right hand, the back of the hand turned up.
5	*Half-cock your firelock!*	1	Half-bend the cock briſkly, with a draw-back of the right elbow, bringing it cloſe to the butt of the firelock.
6	*Handle your cartridge!*	1	Bring your right hand with a ſhort round to your pouch, ſlapping it hard; ſeize the cartridge, and bring it with a quick motion to your mouth; bite the top well off, and bring the hand as low as the chin, with the elbow down.
7	*Prime!*	1	Shake the powder into the pan, placing the three laſt fingers behind the hammer, with the elbow up.
8	*Shut your pans!*	2	1ſt. Shut your pans briſkly, drawing your right arm at this motion towards your body, holding the cartridge faſt in your hand, as in the former poſition. 2d. Turn the piece nimbly round to the loading poſition, with the lock to the front, and the muzzle the height of the chin, bringing the right hand behind the muzzle; both feet kept faſt in this motion.
9	*Charge with cartridge!*	2	1ſt. Turn up your hand, and put the cartridge into the muzzle, ſhaking the powder into the barrel. 2d. Place your hand, cloſed, with a quick and ſtrong motion upon the rammer.
10	*Draw your rammer!*	2	1ſt. Draw the rammer with a quick motion half out, ſeizing it at the muzzle back-handed. 2d. Draw it quite out, turn it, and enter it into the muzzle.

No.	Words of command	Motions	Explanations.
11	*Ram down your charge!*	1	Ram the cartridge well down the barrel, inſtantly recovering and ſeizing the rammer back-handed at the centre, turning it, and entering it as far as the lower pipe, placing at the ſame the edge of the hand on the butt-end of the rammer, with fingers extended.
12	*Return your rammer!*	1	Return the rammer, bringing up the piece with the left hand to the ſhoulder, ſeizing it with the right hand under the cock, keeping the left hand faſt at the ſwell, turning the body ſquare to the front.
13	*Shoulder your firelock!*	2	1ſt. Quit the left hand, and place it ſtrong upon the butt. 2d Quit the right hand, and throw it down the right ſide.
14	*Reſt your firelock!*	3	1ſt. Seize the firelock with the right hand, turning the lock outwards. 2d. Raiſe the firelock from the ſhoulder, and place your left hand with a quick motion above the lock, holding the piece right up and down in both hands before you, and your left hand even with your eyes. 3d. Step briſkly back with your right foot, placing it a hand's breadth diſtance from your left heel, and the ſame time bring down your firelock as quick as poſſible to the reſt, ſinking it as far down before your left hand as your right hand will permit without conſtraint; your left hand at the feather-ſpring, and your right, with fingers extended, held under the guard, taking care to draw in the muzzle well towards your body, and to dreſs in a line with the butt end.
15	*Order your firelock!*	3	1ſt. Place your firelock nimbly, with your left hand, againſt your right ſhoulder. 2d. Quit the firelock with the right hand, ſinking it at the ſame time with your left; ſeize it at the muzzle, which muſt be of an equal height with your chin, and hold it cloſe againſt your right ſide. 3d. Lift up your right foot, and place it by your left; at the ſame time throw back your left hand by your left ſide, and with your right bring down the butt end ſtrong upon the ground, placing it even with the toe of your right foot; the thumb of your right hand lying along the barrel, and the muzzle kept at a little diſtance from your body.
16	*Ground your firelock!*	4	1ſt. Half face to the right upon your heels, and at the ſame time turn the firelock, ſo that the lock may point to the rear, and the flat of the butt-end lie againſt the inſide of your foot; at the ſame time ſlipping the right foot behind the butt of the firelock, the right toe pointing to the right, and the left to the front. 2d. Step directly forward with your left foot, about as far as the ſwell of the firelock, and lay it upon the ground, your left hand hanging down by your left leg, and your right kept faſt, with the butt-end againſt it. 3d. Raiſe yourſelf up again nimbly, bringing back your left foot to its former poſition, keeping your body faced to the right. 4th. Face again to the left upon your heels, and come to your proper front, letting your hands hang down without motion.
17	*Take up your firelock!*	4	1ſt. Face to the right upon both heels. 2d. Sink your body down, and come up to the poſition deſcribed in the ſecond motion of grounding. 3d. Raiſe yourſelf and firelock, bringing it cloſe to your right ſide. 4th. Come to your proper front, ſeizing your firelock at the muzzle, as in *Explanation* 15.
18	*Reſt your firelock!*	3	1ſt. Bring your right hand as far as the ſwell.

No.	Words of command	Motions	Explanations.
			2d. Raiſe the firelock high up in a perpendicular line from the ground with your right hand, and ſeize it with your left above the ſpring; the cock the height of the waiſt-belt. 3d. Step back with your right foot, placing it behind your left heel, and come to the reſt.
19	*Shoulder your firelock!*	2	1ſt. Lift up your right foot, and place it by your left; bring the firelock at the ſame time to your left ſhoulder, and ſeize the butt end with the left hand, keeping it in the ſame poſition as above deſcribed. 2d. Throw your right hand briſkly back.
20	*Secure your firelock!*	3	1ſt. Bring the right hand briſkly up, and place it under the cock, keeping the firelock ſteady in the ſame poſition. 2d. Quit the butt with the left hand, and ſeize the firelock with it at the ſwell, bringing the elbow cloſe down upon the lock; the right hand kept faſt in this motion, and the piece ſtill upright. 3d. Quit the right hand, and bring it down your right ſide, bringing the firelock nimbly down to the *ſecure*; the left hand in a line with the waiſt-belt.
21	*Shoulder your firelock!*	3	1ſt. Bring the firelock up to a perpendicular line, ſeizing it with the righthand under the cock. 2d. Quit the left hand, and place it ſtrong upon the butt. 3d. Quit the right hand, and bring it ſmartly down the right ſide.
22	*Fix your bayonet!*	3	1ſt and 2d motions, as in the two firſt of the *ſecure*. 3d. Quit the right hand, and bring the firelock ſmartly down to the left ſide with the left hand, as far as it will admit without conſtraint, ſeizing the bayonet at the ſame time with the right hand, and fixing it, placing that hand juſt below the braſs, with the piece kept cloſe to the hollow of the ſhoulder.
23	*Shoulder your firelock!*	3	1ſt. Quit the right hand, and bring up the firelock with the left; ſeize it again under the cock with your right, as in the 2d motion of the *ſecure*. 2. Quit the left hand, and place it ſtrong upon the butt. 3d. Quit the right hand, and bring it down the right ſide.
24	*Preſent your arms!*	3	As explained in the 3 motions of the 14th word of command.
25	*To the right face!*	3	1ſt. Bring up the firelock with a quick motion high before you, 'till your left hand comes even with your eyes, with the fingers of that hand extended along the ſtock, juſt above the feather-ſpring; the right foot to be brought cloſe up to the left heel in this motion. 2d. Face to the right, taking care in facing to hold the firelock right up and down, and ſteady in your hands. 3d. Step back with your right foot, and come down to your *preſent*, as in the foregoing explanation.
26	*To the right face!*	3	As in the foregoing explanation, facing to the right.
27	*To the right-about face!*	3	As in the 25th explanation, only coming to the right-about, inſtead of to the right.
28	*To the left face!*	3	1ſt. Bring the right foot briſkly to the hollow of your left with the firelock, in the ſame poſition as in the firſt motion of *facing to the right*. 2. Face to the left. 3. Come down to the *preſent*, as before.
29	*To the left face!*	3	As in the foregoing explanation.
30	*To the left about face*	3	As before, coming to the left-about, inſtead of to the left.
31	*Shoulder your firelock!*	2	As in the two motions of the 19th explanation.
32	*Charge your bayonet!*	2	1ſt. As in explanation 1. 2d. Bring the ſwell of the firelock down ſtrong upon the palm of the hand, graſping the piece at the ſmall, behind the lock, and as high as the waiſt-belt; the fire-

No.	Words of command	Motions	EXPLANATIONS.
			lock upon a level with the barrel upwards.
33	*Shoulder your firelock!*	2	1ſt. Bring up the firelock to the ſhoulder, place the left hand upon the butt, bringing the feet ſquare to the front. 2d. Quit the right hand, and throw it down the right ſide.
34	*Advance your arms!*	4	1ſt and 2d, as in the 1ſt explanation. 3d. Bring the firelock down the right ſide, with the right hand, as low as it will admit without conſtraint, ſlipping up the left hand at the ſame time to the ſwell, the guard between the thumb and fore-finger of the right hand, the three laſt fingers under the cock, with the barrel to the rear. 4th. Quit the left hand.
35	*Shoulder your firelock!*	4	1ſt. Bring up the left hand, and ſeize it at the ſwell. 2d. Come ſmartly up to the poiſe. 3d and 4th. Shoulder.
36	*Prime and load!*	15	1ſt. Come ſmartly to the *recover*, by ſpringing the firelock ſtrait up with the left hand, turning the barrel inwards to the proper height of the recover: at the ſame time that the left hand ſprings the firelock, the right hand is raiſed briſkly from the right ſide, and ſeizes the firelock acroſs the breaſt; as it riſes below the cock, the left hand comes with a quick motion from the butt, and ſeizes the firelock ſtrong above the lock, the little finger of the left hand at the ſpring of the lock, the left hand at an equal height with the face, the butt cloſe to the body, but not preſſed, the firelock perpendicular, oppoſite the left ſide of the face. 2d. Bring the firelock down with a briſk motion to the priming poſition, the left hand holding the firelock, as in priming; the thumb of the right hand placed againſt the face of the ſteel, the fingers clinched, and the elbow a little turned out, that the wriſt may be clear of the cock. 3d. Open the pan by throwing up the ſteel with a ſtrong motion of the right arm, turning the elbow in, and keeping the firelock ſteady in the left hand. 4th. Handle your cartridge. 5th. Priming. 6th. Shut your pans. 7th. Caſt about. 8th and 9th. Load. 10th and 11th. Draw rammers. 12th. Ram down the cartridge. 13th. Return the rammers. 14th and 15th. Shoulder. N. B. The motion of recover, and coming down to the priming poſition, and opening pans, to be done in the uſual time. The motions of handling cartridge to ſhutting the pans, to be done as quick as poſſible: when the pans are ſhut, a ſmall pauſe is to be made, and then caſt about together; then the loading motions are to be done as quick as poſſible; but before the rammer is returned, another ſmall pauſe is to be made, counting 1, 2, between each motion, 'till the firelock is ſhouldered.
	Front rank, make ready!		Spring the firelock briſkly to the *recover*, keeping the left-foot faſt in this motion: as ſoon as the firelock is at the *recover*, without any ſtop, ſink the body briſkly without ſtooping forward, with a quick motion down upon the right knee: the butt end of the firelock at the ſame time falls upon the ground; the front part of the butt to be in a line with the heel of the left foot. So ſoon as the butt comes to the ground, the firelock is to be cocked, immediately ſeizing the cock and ſteel in the right hand; the firelock to be held firm in the left hand, about the middle of that part of the firelock between the lock and the ſwell of the ſtock; the point of the left thumb to be cloſe to the ſwell, pointing upwards.

No.	Words of command	Motions	Explanations.
			As the body is ſinking, the right knee is to be thrown as far back as the left leg may be right up and down; the right foot to be thrown a little to the right; the body to be kept ſtraight; the head up, looking to the right along the rank, the ſame as if ſhouldered; the firelock to be upright, and the butt about 4 inches to the right of the inſide of the left foot.
	Preſent!	1	Bring the firelock briſkly down to the *preſent*, by extending the left arm to the full length with a ſtrong motion; at the ſame time ſpring up the butt by the cock with the right hand, and raiſe up the butt ſo high upon the right ſhoulder, that you may not be obliged to ſtoop too much with the head; the right cheek to be cloſe to the butt, and the left eye ſhut, and look along the barrel with the right eye from the breech-pin to the muzzle; keep the left elbow down in an eaſy poſition, and ſtand as ſteady as poſſible; the thumb of the right hand to remain in the poſition, as deſcribed in the 3d Explanation of the Manual.
	Fire!	1	Pull the trigger, as directed in the Manual, and as ſoon as the piece is fired, give yourſelf a ſtrong ſpring upon your left leg, raiſing your body briſkly, and ſtraight up, keeping your left foot faſt, and bringing the right heel to the inſide of the left; at the ſame time the firelock is to be brought up to the priming poſition, and half-cocked immediately; a ſhort pauſe is to be made, then handle cartridge, and go on with the loading motions deſcribed in the Explanation of *prime and load*.
	Centre rank, make ready!		Spring the firelock briſkly to the *recover*; ſo ſoon as the left hand ſeizes the firelock above the lock, the right elbow is to be nimbly raiſed a little, placing the thumb of that hand upon the cock; the fingers open by the plate of the lock, and as quick as poſſible force the piece to the cock, by dropping the elbow, and forcing down the cock with the thumb, ſtepping at the ſame time a moderate pace to the right, keeping the left foot faſt: as the firelock is cocked, the thumb is to fall below the cock, the right hand ſeizing the firelock cloſe under the cock, firmly; the fore-finger not to be before the trigger; the piece to be held in this poſition perpendicular, oppoſite the left ſide of the face, the butt cloſe to the left breaſt, but not preſſed; the body to be ſtraight, and as full to the front as poſſible; the head kept up, looking to the right of the rank, that the body and the firelock may not ſtoop forward, nor lean much out of the rank.
	Preſent!	1	Spring the firelock from the body to the arm's length with a quick motion, preſſing down the muzzle with the left hand, and ſpring up the butt with the right hand, as in the foregoing Explanation of the *front rank*.
	Fire!	1	As in Explanation 4, in the Manual, with this difference, that the left foot is to be brought up to the right, at the ſame time that the firelock is brought down to the priming poſition.
			The loading motions as in the explanations of priming and loading, and at the laſt motion of ſhouldering, to ſpring to the left again, and cover the file-leaders.
	Rear rank make ready!	1	Recover the firelock, and cock as before directed for the centre rank: as the firelock is recovered and cocked, ſtep briſkly ſtraight to the right, with the right foot a full pace; bring the left heel about 6 inches before the right foot; the body ſtraight, and as ſquare to the front as poſſible, as in Explanation of the *centre rank*.

As

No.	Words of command	Motions	EXPLANATIONS.
	Preſent!	1	As in Explanation *preſent*, before.
	Fire!	1	As in Explanation of the *centre rank*, and as the firelock is coming down to the priming poſition, the left is to be brought back to the right; and at the laſt motion of ſhouldering, to ſpring to the left again, and cover the file-leader.

The WORD, *Watch*-WORD, is a peculiar word that ſerves for a token and mark of diſtinction, given out in the orders of the day in time of peace, but in war time every evening in the field by the general who commands, and in garriſon by the governor, or other officer commanding in chief, to prevent ſurpriſe, and hinder an enemy, or any treacherous perſon to paſs backwards and forwards. This *watch-word* is generally called the *parole*, and to which is added the *counterſign*. The firſt is known to all officers and non-commiſſioned officers, the latter only to the ſentinels. The parole is this day, at Coxheath camp, *England*, and the counterſign, *Amherſt*. The officers that go the rounds, or patroles, exchange the word with the officers on duty; nor will the ſentinels let any one paſs that has not got the counterſign.

WORDS *of command uſed at the manual exerciſe of the grenadiers, when apart from the battalion.*

No.	Words of command	Motions	EXPLANATIONS.
1	*Grenadiers, take care!*	1	The grenadiers bring the right hand briſkly to the front of their caps; pauſe a little, and bring them down with a flap on their pouches, with life; in which motions, neither your heads, bodies, nor firelocks, are to move. N. B. *Poiſe your firelock! Cock your firelock! Preſent! Fire!* as in N°. 1, 2, 3, and 4, of the Manual Exerciſe.
2	*Sling your firelocks!*	3	1ſt. Bring the ſling with the left hand oppoſite to the right ſhoulder, and the firelock with the right hand oppoſite the left ſhoulder, by croſſing of both hands at the ſame time, bringing the left hand within the right, keeping the muzzle upright, the barrel to the left, and the right hand juſt under the left elbow. 2d. Bend the firelock back, and bring the ſling over your head, placing it juſt above your right ſhoulder. 3d. Draw the ſling with your left hand, and let go the firelock with the right at the ſame time, that it may hang by the ſling on the right ſhoulder, the muzzle upwards, dropping both hands down by your ſides at the ſame time.
3	*Handle your matches!*	3	1ſt. Bring both hands directly before you with half-ſtretched-out arms, about the height of your ſhoulders, taking hold of the lower end of the match with the right hand, placing the thumb under, and the two fore-fingers above. 2d. Bring the match with the right hand over the back of the left, placing it between the thumb and 2 fore-fingers of the ſaid hand. 3d. Puſh out your left hand with the match ſtraight forward, by extending the arm at full length, and at the ſame time bring your right hand down to your right ſide.
4	*Handle your grenades!*	3	1ſt. Keep your left hand extended to the front, as before, and face nimbly to the right, ſtretching out your right arm at the ſame time the height of your ſhoulder, pointing directly to the rear. 2d. Clap your right hand briſkly

No.	Words of command	Motions	EXPLANATIONS.
			on your pouch, ſeizing your grenade. 3d. Bring your right hand to its former poſition, placing the thumb againſt the fuze.
5	*Open your fuze!*	3	1ſt. Keep your left hand extended to the front, and bring the grenade with your right hand to your mouth. 2d. Open the fuze with your teeth. 3d. Puſh your arm briſkly from you, to its former place.
6	*Guard your fuze!*	1	Cover your fuze with your thumb, without making any other motion.
7	*Blow your matches!*	2	1ſt. Bring the match with your left hand before your mouth. 2d. Blow it off with a ſtrong blaſt, puſhing back your hand at the ſame time to its former poſition.
8	*Fire and throw your grenades!*	3	1ſt. Meet the grenade with your left hand oppoſite to your right thigh, inclining your body to the right ſide, bending the right knee, and keeping the left ſtiff, firing the fuze at the ſame time. 2d. Let the fuze be well lighted; then throw the grenade with a ſtiff arm, ſtepping forward at the ſame time with the right foot, placing it in a line with the left, extending both arms in a direct line to the front, keeping the left uppermoſt, and the body upright. 3d. Bring your right hand down to your ſide, keeping your left in its former poſition.
9	*Return your matches!*	3	1ſt. Bring both hands before you, as directed by the firſt motion of Explanation 3. 2d. Bring the match back to its former place, between the 2 laſt fingers of the left hand. 3d. Let both hands fall down by your ſides.
10	*Handle your ſlings!*	3	1ſt. Seize the ſling with both hands at the ſame time, taking hold of it with the right hand about the middle, and as low as you can reach, without bending your body. 2d. With the left hand bring the butt forwards, ſlipping your left elbow under the firelock, by bringing it between the firelock and the ſling; taking hold of the firelock at the ſame time with the left hand, letting the ſtock lie between the thumb and fore finger, the butt end pointing a little to the left with the barrel upwards. 3d. Bring the firelock to lie on the left ſhoulder, and the ſling on the right, the barrel upwards, and the butt end pointing directly to the front, keeping the firelock to a true level. N. B. The reſt of the exerciſe is the ſame as the regiment.

WORDS *of command uſed by the cavalry on horſeback.*

It is preſumed that the men are taught to ride, and the horſes dreſt, in order to perform the following exerciſe.

		[N. B. That no movement be made until the word *march* is given.]
1	*Centre & rear rank move forward to cloſe order. March!*	The two rear ranks of each ſquadron march forward and cloſe ſo near, that only 4 men may juſt wheel round between each rank. The quarter-maſters to be on the right of their reſpective ſquadrons, to give the ranks their proper diſtance, and to dreſs them, and then repair to their poſts in the rear. This movement is to be done at a walk, and the men are to obſerve their right and left-hand men, that the ranks may be even in marching.
2	*Officers rein back into the front rank!*	At this word of command, the front rank of each ſquadron is to open a little to the right and left, to make proper intervals for the officers to fall into, who are to

No.	Words of command	Motions	Explanations.
			wait for the following word of command.
3	*March!*		The officers rein back in a direct line into the front rank of the men, and dreſs with them: the cornets are to take the ſtandards from the men.
4	*Shorten your bridles!*	5	1ſt. Seize the upper end of the reins of the bridle, which is to lie on the right ſide of the horſe, with the right hand. 2d. Bring it up as high as your chin, keeping your right elbow on a level with the ſhoulder. 3d. Slip your left hand along the reins of the bridle, and take hold of the loop or button, which is near the upper end of the reins. 4th. Slip the loop down with the left hand as low as the pomel of the ſaddle. 5th. Bring the right hand down with life on the right holſter-cap, quitting the reins of the bridle with both hands.
5	*Make ready your carbines!*	1	Unfaſten the ſtrap that holds the carbine; then bring your arm under it, ſeizing it about the middle with the right hand, letting it lie between the fore finger and thumb, and raiſing it a little, that the muzzle may run up by the point of the right ſhoulder.
6	*Advance your carbines!*	3	1ſt. Raiſe your carbine upright in the bucket, ſlipping your hand at the ſame time up the barrel as high as the ſhoulder, with the elbow ſquare. 2d. Slip the right hand down the barrel as low as you can without inclining the body, and graſp it with a full hand. 3d. Bring up the carbine with the right hand, and place the butt end on the upper part of the right thigh, near the body, turning the barrel towards you at the ſame time, the muzzle ſloping to the front.
7	*Handle your ſwivels!*	2	1ſt. Seize the ſwivel with your left hand, placing the thumb on the ſpring. 2d. Bring the ſwivel to the left ſide of the carbine, oppoſite to the ring which you are to ſpring it to, raiſing your elbow as high as your hand.
8	*Spring your carbines!*	3	1ſt. Open the ſwivel, by preſſing your left thumb, and put it into the ring of the carbine, and then eaſe your thumb that the ſpring may cloſe. 2d. Quit the carbine with the right hand, and take hold of the ſmall part of the butt a little below the lock with a full hand. 3d. Quit the ſwivel with the left hand, and bring it to its proper place.
9	*Drop your carbines!*	1	Drop the carbine on the right ſide, hanging by the ſwivel, and the muzzle lying croſs the middle of the right toe; at the ſame time taking hold of the bridle with the left hand, and quitting the carbine with the right.
10	*Join your right hands to your ſwords!*	1	Bring your right hand over your left arm, which arm you are to preſs cloſe to your left ſide, and ſeize the handle of the ſword with a full hand.
11	*Draw your ſwords!*	2	1ſt. Draw your ſword quite out of the ſcabbard, by raiſing up the right hand as high as your arm will permit, and keep the point of the ſword a little higher than the hilt. 2d. Bring your right hand to your right ſide, placing the inſide of the hilt on the outſide of your right thigh, the wriſt bending a little out, raiſing the point very high, in a right line with the right ear of the horſe, with the edge from you.
12	*Place your ſwords in the bridle hands!*	2	1ſt. Bring up the ſword oppoſite to the centre of the body, reſting the pomel on the fore part of the ſaddle, the broad part of the blade towards you, and the point upright; at the ſame time you are to ſlip up your left hand along the reins of the bridle as high as your ſhoulder, and ſeize the blade with your left hand, keeping the reins between the

palm

No.	Words of command	Motions	Explanations.
			palm and it, and ſquaring the left elbow. 2d. Quit the ſword with the right hand, and bring it to its proper place.
13	*Handle your carbines!*	1	Seize the round or ſmall part of the butt with your right hand as high as your ſhoulder, and bring it immediately down to the aforementioned place.
14	*Advance your carbines!*	1	Bring your carbine with your right hand, placing it on your right thigh, as in Explanation 6.
15	*Cock your carbines!*	2	1ſt. Bring the right elbow forward, and place the right thumb on the cock. 2d. Bring down your right elbow to your ſide, cocking the carbine at the ſame time, and ſlipping the thumb off the cock.
16	*Preſent!*	1	Bring up the carbine, and place the butt end firm to the hollow of the right ſhoulder, dropping the muzzle to a level on the right ſide of the ſword, and ſupport it with the fingers of the left hand, which you are to extend for that purpoſe, and place the fore finger of the right hand before the trigger, and the other three on the guard, the thumb in the hollow of the butt, your body inclining a little forward only to preſs againſt the carbine, keeping your head up, and looking ſtraight forward.
17	*Fire!*	1	Draw the trigger briſkly with that finger that was placed before it; but ſhould it not go off with the firſt drawing, you are not to draw it a ſecond time.
18	*Drop your carbines!*	1	Drop your carbines on the right ſide, as in Explanation 9.
19	*Handle your right piſtols!*	1	Bring your right hand round, turning the back towards you, and ſeize the butt of the right piſtol with a full hand.
20	*Draw your right piſtols!*	1	Draw your right piſtol out of the holſter, and bring it to the right ſide of the ſword, extending your arm directly before you, with the muzzle upright.
21	*Cock your piſtols!*	2	1ſt. Bring the piſtol cloſe to your breaſt, keeping the muzzle up, and place your thumb on the cock. 2d. Throw off the piſtol to its former place, cocking at the ſame time, and ſlip your thumb off the cock.
22	*Preſent!*	1	Drop the muzzle to a level, the barrel upward, and place the fore finger on the trigger, as in Explanation 16.
23	*Fire!*	1	Draw the trigger, as in Explanation 17.
24	*Return your piſtols!*	3	1ſt. Place the muzzle of your piſtol in the holſter, the back of your hand turned towards you. 2. Thruſt it quite down. 3. Quit the piſtol, and bring your right hand to its proper place.
25	*Handle your left piſtols!*	1	Do this as in Explanation 19, only the back of your hand from you.
26	*Draw your piſtols!*	1	As in Explanation 20.
27	*Cock your piſtols!*	2	As in Explanation 21.
28	*Preſent!*	1	As in Explanation 22.
29	*Fire!*	1	As in Explanation 17.
30	*Return your piſtols!*	3	As in Explanation 24.
31	*Recover your ſwords!*	2	1ſt. Seize the handle of the ſword with the right hand, graſping it with the thumb upwards. 2d. Bring the ſword to the right thigh, as in Explanation 11; at the ſame time ſlip down your left hand, and take hold of the bridle at the proper place.
32	*Point your ſwords!*	1	Bring your ſword over the left arm, and enter the point in the ſcabbard, and thruſt it ſo far, that you may look over the right arm.
33	*Return your ſwords!*	2	1ſt. Thruſt your ſword up to the hilt. 2d. Bring your hand back to its proper place.
34	*Officers move into the front. March!*		The commiſſioned officers are to march out of the ranks, the cornets bringing the ſtandards with them, and place themſelves at the head of the ſquadrons. As ſoon

No.	Words of command	Motions	Explanations.
			ſoon as the officers are clear of the men, the front ranks are to cloſe the intervals, made by the officers, to the centre.
35	*Centre and rear ranks rein back to open order. March!*		The centre and rear ranks of each ſquadron are to rein back very ſlow, in a direct line to their former ground, keeping their ranks and files even; of which the quarter-maſters are to take particular care, as alſo that there be a due diſtance between the ranks, according to the direction in Article 8.
36	*Handle your carbines!*	1	This is to be done as in Explanation 13.
37	*Advance your carbines!*	1	As in Explanation 14.
38	*Unſpring your carbines!*	1	Quit the reins of your bridle, and take hold of the ſwivel with the left hand, placing the thumb on the ſpring, and opening it; at the ſame time take it out of the ring.
39	*Return your ſwivels!*	2	1ſt. Place the ſwivel on your right ſide, by thruſting your left hand under your right arm. 2d. Bring your left hand back to its proper place.
40	*Return your carbines!*	4	1ſt. Throw the carbine to the right with the right hand, turning the barrel to the front, ſinking it as low as you can without inclining your body, ſeizing the barrel at the ſame time with your left hand, and keeping the muzzle upright. 2d. Quit the right hand, and bring the carbine with the left hand under the right arm, ſinking it near the bucket, and at the ſame time ſeize the barrel with the right hand a little above the left. 3d. Place the butt end of the carbine in the bucket, and quit it with the left hand. 4th. Faſten the carbine with the ſtrap, and place your bridle in your left hand.

WORDS *of command for diſmounting, linking the horſes, &c.*

1	*Diſmount!*	6	1ſt. Take your right foot out of the ſtirrup, at the ſame time thruſting forward your bridle-hand, keeping the reins faſt. 2d. Take a lock of the horſe's mane with the right hand, and put it in the left, over the bridle, and graſp it faſt with the left hand. 3d. Take hold with the right hand of the right bar of the ſaddle, placing your fingers on the inſide, and your thumb on the outſide. 4th. Raiſe yourſelves with the right hand above the ſaddle, and bring the left leg over to the near or left ſide of the horſe, with an upright body, looking full to the right. 5th. Come briſkly to the ground with the right foot, facing full to the rear, and then quit the ſtirrup with the left, bringing it down to the ground, and place it even with the other. 6th. Quit the bridle and mane with the left hand, wheeling at the ſame time to the left-about on the right heel, and take hold of the left cheek of the bridle with the right hand.
2	*Make ready your links!*		As there are ſeveral ſorts of links, there cannot be one method preſcribed for the whole; but as moſt regiments link with collars, we will proceed in that way. The collar being faſtened by a running knot to a ring on the ſaddle, a little above the right holſter, the men are to undo the knot with the right hand, taking the rein of the collar out of the ring, and laying it croſs the horſe's neck.

Words *of command uſed at the exerciſe of the artillery, together with the number of hands and implements for that purpoſe.*

On batteries, there are eight men required in the management and exerciſe of a heavy piece of artillery, who are poſted in the following manner.

1ſt. A non-commiſſioned officer to ſuperintend the whole: his duty is, to point the gun at the object, and to obſerve the effects of each ſhot.

2d. A man to load, placed on the left of the gun. When the piece is to be loaded with a paper or parchment cartridge, he muſt be provided with a pen-knife or pair of pointed ſciſſars, to cut an oblong hole in the upper part of the cartridge oppoſite the ſeam, beginning at the bottom, about 3 inches long, and 2 broad, and double the paper back upon the cartridge, which he then puts into the piece. This opening is to let the priming communicate with the charge.

3d. A man to load with the ladle, to ſponge and ram home: his poſt is on the right of the gun. Theſe two men are carefully to avoid expoſing their bodies in the line of fire, while loading.

4th. A man to ſerve the vent: his poſt is on the right of the gun, near the breech, but clear of the carriage.

5th. A man to fire: his poſt is on the left of the gun, near the breech, but clear of the carriage.

6th and 7th. Two men to handle the hand-ſpikes: they are placed on each ſide of the carriage.

8th. A man to ſerve with ammunition from the magazine, waggon, or cheſt: he is to be provided with a leather pouch, and is to ſtand about 40 or 50 paces in the rear.

N. B. At exerciſe, the arms are either piled or placed againſt the parapet, and the implements ranged in the following manner, viz. a ſponge and ladle upon the right; a ſponge and wad-hook upon the left; the hand-ſpikes upon the right and left.

In the field there are 13 men and 1 non-commiſſioned officer, poſted as follows, viz.

1ſt. A non-commiſſioned officer to ſuperintend the whole: his chief care is to point the gun, and obſerve the effects of each ſhot.

2d. A non-commiſſioned officer, or an able gunner, to ſteer and direct the gun: his poſt is on the left.

3d. A man to fire: his poſt is on the left of the gun.

4th. A man to ſerve the vent: his poſt is on the right of the gun.

5th. A man to load: his poſt is on the left of the gun, between the muzzle and the wheel.

6th. A man to ſponge and ram home: his poſt is on the right of the gun, between the muzzle and the wheel.

7th. A man to ſerve with ammunition: his poſt is on the left of the gun, without the wheel.

8th. A man to ſerve ammunition from the magazine, waggons or cheſt; poſted about 30 or 40 paces in the rear of the gun.

9th. Six men at the drag-ropes, which lay hold of the wooden pins; 3 men to each drag-rope.

N. B. The number of men for the drag-ropes muſt be in proportion to the nature of the guns.

At exerciſing the ſlow motions, a hand-ſpike is laid on the ground in the front of the wheels; the ladle with the mouth downwards on the right, the wad-hook on the left, and the ſponge in the centre.

Table *of the number of men requiſite for working the under-mentioned guns and howitzers.*

Species	Cannon					Howitzers		
Natures	24	12	9	6	3	8	$5\frac{4}{5}$	$4\frac{2}{5}$
To ſuperintend, non-commiſſioned officers	1	1	1	1	1	1	1	1
To ſteer the guns	1	1	1	1	1	1	1	1
To prime and fire	2	2	2	2	2	2	2	2
To load and ſet home	2	2	2	2	2	2	2	2
To the drag-ropes	12	10	8	6	4	8	4	4
To unload the waggon	4	3	3	2	1	3	2	2
Total	22	19	17	14	11	17	12	12

N. B. The above guns are all of the light ſort, except the 8-inch howitzer.

Inſtead of Words of Command *at the exerciſe of artillery, the drum beats* Signals, *viz.*

No.	Signals by the drum.	Explanations.
1	*Preparative.*	To fire two rounds from the flanks to the centre, or more if the officer who commands chuſes.
2	*Firſt part of the general.*	To ceaſe firing, as above directed.
3	*March.*	To advance; that is, the men at the drag-ropes advance the pieces in battery, in a direct line.
4	*Preparative.*	The firing commences again, advancing.
5	*Firſt part of the general.*	To ceaſe firing, advancing.
6	*Flam.*	To unhook the drag-ropes, and fix them to the trail of the gun-carriage.
7	*t.*	To retreat; that is, the line begins to retreat, by the men at the drag-ropes, retreating the pieces in battery, firing as they retreat.
8	*Firſt part of the general.*	To halt and ceaſe from firing; at which time the men at the drag-ropes draw up in a line, holding the drag-ropes in their hands, and the men at their proper ſtations.
9	*Flam.*	To unhook the drag-ropes, and fix them to the draught-rings at the end of the axle-tree; to be in readineſs for advancing.
10	*Long-roll.*	To change about; that is, no one ſhould be kept to one particular poſt, but changed regularly; ſo that each man be equally acquainted with every part of his duty.

N. B. The Mortar and Howitzer exerciſe is ſimilar to this. The men are likewiſe taught to mount and diſmount all kinds of artillery, &c. as alſo to rig and unrig a gin.

WORKMEN, are perſons that attend the ammunition, boatſmen, carpenters, ſmiths, millers, bakers, waggoners, miners, pioneers, &c.

WORKS, are generally underſtood of the fortifications about the body of a place; as by *out-works* are meant thoſe without the firſt incloſure. The word is alſo uſed to ſignify the approaches of the beſiegers, and the ſeveral lines, trenches, &c. made round a place, an army, or the like, for its ſecurity.

WOODEN *bottoms,* in *laboratory works,* are cylindrical pieces of wood, of different lengths and diameters, agreeable to the ſize of the gun: they are hollowed at one end to receive the ſhot, and the flannel cartridge is faſtened to the other end; the whole forming one cartridge, which is put into the piece at one motion.

WOOL-*packs,* in the *art of war,* are frequently ranged in form of a breaſt-work, becauſe they reſiſt cannon-ſhot. See Siege.

Y

YEOMAN, in *military affairs,* was anciently a kind of ceremonious title given to the ſoldiers.

Yeomen *of the guards,* were anciently 250 men of the beſt rank, under gentry, and of larger ſtature than ordinary, each being required to be 6 feet high. At preſent there are but 100 yeomen in duty, and 70 more not in duty; and as any of the hundred dies, his place is ſupplied out of the 70. This corps was firſt inſtituted by Henry VII. anno 1486.

YOUNGER *regiment,* is that which was laſt raiſed. See Seniority.

Younger *officer,* is he whoſe commiſſion is of the lateſt date, though he be ever ſo old a man, or have ſerved ever ſo long in other capacities; and according to theſe rules, regiments and officers are poſted and commanded. See Seniority.

Z

ZIG-ZAG, in the *art of war,* is a line making ſeveral angles, in approaching or erecting a work in a ſiege, &c. to prevent the beſiegers from being fired on in a ſtraight line, or enfiladed.

SUPPLEMENT.

*The Words marked * are Omiſſions; the others, not marked, are further Explanations of Words already mentioned in the Work.*

A

ABLECTI, in *military antiquity*, a choice or ſelect part of the ſoldiery in the Roman armies, picked out of thoſe called *extraordinarii.*

* ABOLLA, in *military antiquity*, a warm kind of garment, generally lined or doubled, uſed both by the Greeks and Romans, chiefly out of the city, in following the camp.

* ABSCISSA, in *military mathematics*, ſignifies any part of the diameter or axis of a curve, contained between its vertex or ſome other fixed point, and the interſection of the ordinate.

In the parabola, the *abſciſſa* is a third proportional to the parameter and the ordinate.

In the ellipſis, the ſquare of the ordinate is equal to the rectangle under the parameter and *abſciſſa*, leſſened by another rectangle under the ſaid *abſciſſa*, and a fourth proportional to the axis, the parameter, and the *abſciſſa.*

In the hyperbola, the ſquares of the ordinates are as the rectangles of the *abſciſſa* by another line, compounded of the *abſciſſa* and the tranſverſe axis.

But it muſt be remembered, that the two proportions relating to the ellipſis and hyperbola, the origin of the *abſciſſas*, or point from whence they began to be reckoned, is ſuppoſed to be the vertex of the curve, or, which amounts to the ſame thing, the point where the axis meets it; for if the origin of the *abſciſſas* be taken from the centre, as is often done, the above proportions will not be true.

ACADEMY, is more frequently uſed amongſt the moderns for a regular ſociety, or company, of learned perſons, inſtituted under the protection of a prince, for the cultivation and improvement of arts or ſciences. Some authors confound *academy* with univerſity; but, though much the ſame in Latin, they are very different things in Engliſh. An univerſity is, properly, a body compoſed of graduates in the ſeveral faculties; of profeſſors, who teach in the public ſchools; of regents or tutors, and ſtudents who learn under them, and aſpire likewiſe to degrees: whereas an *academy* was originally not intended for teaching, or to profeſs any art, but to improve it; it was not for novices to be inſtructed in, but for thoſe who were more knowing, for perſons of diſtinguiſhed abilities to confer in, and communicate their lights and diſcoveries to each other, for their mutual benefit and improvement. The firſt *academy* we read of, was eſtabliſhed by Charlemagne, at the motion of Alcuin: it was compoſed of the chief wits of the court, the emperor himſelf being a member.

*ACANZI, in *military hiſtory*, the name of the Turkiſh light-horſe that form the van-guard of the Grand Signior's army on a march.

*ACCENDONES, in *military antiquity*, a kind of gladiators, whoſe office was to excite and animate the combatants during the engagement.

ACCENSI, in *military antiquity*, was alſo an appellation given to a kind of adjutants, appointed by the tribune to aſſiſt each centurion and decurion.

*ACOLUTHI, in *military antiquity*, was a title in the Grecian empire, given to the captain or commander of the *varangi*, or body-guards, appointed for the ſecurity of the emperor's palace.

* ACCONTIUM, in *ancient military writers*, a kind of Grecian dart or javelin, ſomewhat reſembling the Roman *pilum*.

ACCOUTREMENTS, ſhould be made of ſtout, ſmooth buff, as well for the ſervice to be expected from them, as for their ſuperior look above the ſpongy kind, which is always ſtretching, and difficult to clean. The buff belts are about 2¼ inches broad, with two buckles to fix them to the pouch. Pouches are made of the ſtouteſt blackened calf-ſkin, eſpecially the outſide flaps, which are of ſuch a ſubſtance as to turn the ſevereſt rain. Cartridge-boxes are made as light as poſſible, with 36 holes in each, to hold ſo many cartridges. The bayonet-belt is alſo 2¼ inches broad, and better worn over the ſhoulder than about the waiſt.

* ÆNEATORES, in *military antiquity*, the muſicians in an army; including thoſe who ſounded the trumpets, horns, *litui*, *buccinæ*, &c.

* AGE, in a *military ſenſe*, or that wherein the Romans were obliged to enter themſelves in the army, was at 17 years; at 45 they might demand their diſmiſſion. Amongſt the Lombards, the *age* of entry was between 18 and 19; among the Saxons, at 13.

* AGEMA, in the *ancient military art*, a kind of ſoldiery chiefly in the Macedonian armies. The word is Greek, and litterally denotes vehemence; to expreſs the ſtrength and eagerneſs of this corps. Some authors will have *agema* to denote a certain number of picked men, anſwering to a legion among the Romans.

* AGGER, in *ancient military writers*, denotes the middle part of a military road, raiſed into a ridge, with a gentle ſlope on each ſide, to make a drain for the water, and keep the way dry.

AGGER, is alſo uſed for the whole road, or military way. Where highways were to be made in low grounds, as between two hills, the Romans uſed to raiſe them above the adjacent land, ſo as to make them of a level with the hills. Theſe banks they called *aggeres*. Bergier mentions ſeveral in the *Gallia Belgica*, which were thus raiſed 10, 15, or 20 feet above ground, and 5 or 6 leagues long. They are ſometimes alſo called *aggeres calceati*, or cauſeways, as with us.

AGGER, alſo, denotes a work of fortification, uſed both for the defence and the attack of towns, camps, &c. in which ſenſe, *agger* is the ſame with what was otherwiſe called *vallum*, and in latter times, *ageſtum*; and among the moderns, *lines*; ſometimes, *cavaliers*, *terraſſes*, &c.

The *agger* was uſually a bank, or elevation of earth, or other matter, bound and ſupported with timber; having ſometimes turrets on the top, wherein the workmen, engineers, and ſoldiery, were placed. It was alſo accompanied with a ditch, which ſerved as its chief defence. The height of the *agger* was frequently equal to that of the wall of the place. Cæſar tells us of one he made, which was 30 feet high, and 330 feet broad. Beſides the uſe of *aggers* before towns, they generally uſed to fortify their camps with the ſame; for want of which precaution, divers armies have been ſurpriſed and ruined.

There were vaſt *aggers* made in towns and places on the ſea-ſide, fortified with towers, caſtles, &c. Thoſe made by Cæſar and Pompey, at Brunduſium, are famous. Sometimes *aggers* were even built acroſs arms of the ſea, lakes, and moraſſes; as was done by Alexander before Tyre, and by M. Antony and Caſſius.

The wall of Severus, in the north of England, may be conſidered as a grand *agger*, to which belong ſeveral leſſer ones. Beſides the principal *agger* or *vallum*, on the brink of the ditch, Mr. Horſley deſcribes another on the ſouth ſide of the former, about 5 paces diſtant from it, which he calls the ſouth *agger*; and another larger one, on the north ſide of the ditch, called the north *agger*. This latter he conjectures to have ſerved as a military way; the former, probably, was made for the inner defence, in caſe the enemy ſhould beat them from any part of the principal *vallum*, or to protect the ſoldiers againſt any ſudden attack from the provincial Britons.

AGGER *Tarquinii*, was a famous fence built by Tarquinius Superbus, on the eaſt ſide of Rome, to ſtop the incurſions of the Latins, and other enemies, whereby the city might be inveſted.

AGGER, is alſo uſed for the earth dug out of a ditch or trench, and thrown upon the brink of it: in which ſenſe, the Chevalier Folard thinks the word to be underſtood, when uſed in the plural number, ſince we can hardly ſuppoſe they would raiſe a number of cavaliers, or terraſſes.

AGGER, is alſo uſed for a bank or wall, erected againſt the ſea, or ſome great river, to confine or keep it within bounds; in which ſenſe, *agger* amounts to the ſame with what the ancients called *tumulus* and *moles*; the Dutch, *dyke*; and we, *dam*, *ſea-wall*, &c.

* **AGIADES**, in the *Turkiſh armies*, are a kind of pioneers, or rather field-engineers, employed in fortifying camps, &c.

* **ALLÆ**, in the *ancient military art*, the two wings or extremes of an army ranged in order of battle.

ALLIANCES, are variouſly diſtinguiſhed, according to their object, the parties in them, &c. Hence we read of equal, unequal, triple, quadruple, grand, offenſive, defenſive *alliances*, &c. See ALLIANCE, in the firſt Alphabet.

ALTITUDE *of a figure*, is the diſtance of its vertex from its baſe, or the length of a perpendicular let fall from the vertex to the baſe.

ALTITUDE *of a ſhot or ſhell*, is the perpendicular height of the principal vertex above the horizon. See GUNNERY and PROJECTILES.

ALTITUDE, in *optics*, is uſually conſidered as the angle ſubtended between a line drawn through the eye, parallel to the horizon, and a viſual ray emitted from an object to the eye.

ALTITUDE, in *coſmography*, is the perpendicular height of an object, or its diſtance from the horizon upwards.

ALTITUDES are divided into *acceſſible* and *inacceſſible*.

Acceſſible ALTITUDE *of an object*, is that whoſe baſe you can have acceſs to, i. e. meaſure the neareſt diſtance between your ſtation and the foot of the object on the ground.

Inacceſſible ALTITUDE *of an object*, is that when the foot or bottom of it cannot be approached, by reaſon of ſome impediment; ſuch as water, or the like. The inſtruments chiefly uſed in meaſuring of *altitudes*, are the quadrant, theodolite, geometric quadrant, or line of ſhadows, &c.

ALTITUDE *of the eye*, in *perſpective*, is a right line let fall from the eye, perpendicular to the geometrical plane.

AMMUNITION, or *gun-powder*, may be prohibited to be exported at the king's pleaſure, by Car. II. cap. 4. § 13.

AMMUNITION. Arms, utenſils of war, or gunpowder, imported without licence from his majeſty, are to be forfeited with treble the value. Such licence obtained, except for the furniſhing his majeſty's public ſtores, is to be void, and the offender to incur a premunire, and be diſabled to hold any office from the crown. See AMMUNITION, in the firſt Alphabet.

Proportion of AMMUNITION *for the following troops for one year, commencing the 25th of March, 1760, agreeable to the king's warrant, in time of peace.*

		Pow.	Ball			Flints		
		Barrels	Muſquets	Carbines	Piſtols	Muſquets	Carbines	Piſtols
			C.	C.	C.	N°.	N°.	N°.
A regiment of foot of 900 men	ſervice	13½	35	—	—	2700	—	—
	exerciſe	19	11	—	—	1800	—	—
A reg. of dragoons of 360 men	ſervice	5	9	—	2	1134	—	2263
	exerciſe	7	1	—	—	756	—	1512
A light troop of 121 men	ſervice	2½	—	7	—	—	363	393
	exerciſe	1½	—		—	—	242	262

N. B. The proportion of *ammunition* for a regiment of foot is 64 rounds for each man for ſervice, at 6 drams each cartridge; and 135 rounds for each man for exerciſe, at ¼ of an ounce.

Muſquet-flints, 3 to each man for ſervice, and 2 for exerciſe.

Muſquet-balls, 20 to each man for exerciſe.

The proportion for a regiment of dragoons is, 1lb. of powder for ſervice, and 2lb. for exerciſe, to each man; each cartridge to contain the ſame as thoſe of the foot.

The proportion for the light-dragoons is 64 rounds for each man for ſervice, at ½ an ounce each cartridge, and 405 rounds each man, for exerciſe, at 3 drams each cartridge.

The royal regiment of artillery, as much as the commanding officer thinks proper.

The militia when embodied to have the ſame as a regiment of foot, according to their numbers.

* **ANACLETICUM**, in the *ancient art of war*, a particular blaſt of the trumpet, whereby the fearful and flying ſoldiers were rallied and recalled to the combat.

* **ANDABATÆ**, in *military antiquity*, a kind of gladiators, who fought hoodwinked; having a ſort of helmet that covered the eyes and face.

They were called *andabatæ, quaſi αναβατι, aſcenſores*, becauſe they fought mounted on horſeback, or out of chariots.

* ANGARIA, in *ancient military writers*, means a guard of ſoldiers poſted in any place for the ſecurity of it.

ANGON, in *ancient military hiſtory*, a kind of javelin uſed by the French. The iron head of it reſembles a fleur-de-lis; and it is the opinion of ſome writers, that the arms of France are not fleurs-de-lis, but the iron point of the *angon* or javelin of the ancient French. See Angon, in the firſt Alphabet.

* AQUEDUCTS, in *military architecture*, are generally made to bring water from a ſpring or river to a fortreſs, &c. they are likewiſe uſed to carry canals over low ground, and over brooks or ſmall rivers: they are built with arches like a bridge, only not ſo wide, and are covered above by an arch, to prevent duſt or dirt from being thrown into the water. See Muller's *Practical Fortification.*

ARAIGNE. See Gallery and Mine.

ARBALET, in the *ancient art of war*, a croſs-bow, made of ſteel, ſet in a ſhaft of wood, with a ſtring and trigger, bent with a piece of iron fitted for that purpoſe, and uſed to throw bullets, large arrows, darts, &c.

ARCHERS, in *military hiſtory*, a kind of militia or ſoldiery, armed with bows and arrows. They were much uſed in former times, but now laid aſide, excepting in Turkey, and ſome of the eaſtern countries.

ARCHERY, the art of ſhooting with bow and arrow. It is forbid, by ſtatute, to ſhoot at a ſtanding mark, unleſs it be for a rover, where the *archer* is to change his mark at every ſhot. Any perſon above 24 years old is alſo forbid to ſhoot with any prick-ſhaft, or ſlight, at a mark of eleven ſcore yards or under. 33 Hen. VIII. chap. 9. The former was a proviſion for making good markſmen at fight; the latter, for giving ſtrength and ſinews. See Archery, in the firſt Alphabet.

ARMATURA, is alſo an appellation given to the ſoldiers who were light-armed. Aquinus ſeems, without reaſon, to reſtrain *armatura* to the *tyrones*, or young ſoldiers, in it. Under this word is underſtood, the throwing of the ſpear, javelin, ſhooting with bows and arrows, &c.

Armatura, is alſo a denomination given to the ſoldiers in the emperor's retinue. See Armatura, in the firſt Alphabet.

ARMS, in a *general ſenſe*, includes all kinds of weapons, whether for defence or offence. It is ſuppoſed, that the firſt artificial arms were of wood, and only employed againſt beaſts; and that Belus, the ſon of Nimrod, was the firſt that waged war: whence, according to ſome, came the appellation *bellum.* Diodorus Siculus takes Belus to be the ſame with Mars, who firſt trained ſoldiers up to battle. *Arms* of ſtone, and even of braſs, appear to have been uſed before they came to iron and ſteel. Joſephus aſſures us, that the patriarch Joſeph firſt taught the uſe of iron arms in Egypt, arming the troops of Pharoah with a caſque and buckler.

The principal *arms* of the ancient Britons were hatchets, ſcythes, lances, ſwords, and bucklers: the Saxons, &c. brought in the halberd, bow, arrows, arbalets, &c. By the ancient laws of England, every man was obliged to bear arms, except the judges and clergy. Under Henry VIII. it was expreſsly enjoined on all perſons to be regularly inſtructed, even from their tender years, in the exerciſe of the *arms* then in uſe, viz. the long-bow and arrows; and to be provided with a certain number of them.

By the common law, it is an offence for perſons to go or ride armed with dangerous weapons; but gentlemen, both in and out of the army, may wear common armour, according to their quality. The king may prohibit force of *arms*, and puniſh offenders according to law; and herein every ſubject is bound to be aiding. Stat. 7 Edw. I. None ſhall come with force and *arms* before the king's juſtices, nor ride armed in affray of the peace, on pain to forfeit their armour, and to ſuffer impriſonment, &c. 2 Edw. III. c. 3. The importation of *arms* and ammunition is prohibited by 1 Jac. II. c. 8, and by William and Mary, ſtat. 2. c. 2. So likewiſe *arms*, &c. ſhipped after prohibition, are forfeited, by 29 Geo. I. c. 16. ſec. 2.

Arms *of parade*, or *courteſy*, were thoſe uſed in the ancient juſts and tournaments; which were commonly unſhod lances, ſwords without edge or point, wooden ſwords, and even canes. See Arms, in the firſt Alphabet.

ARMY. Our armies anciently were a ſort of militia, compoſed chiefly of the vaſſals and tenants of the lords. When each company had ſerved the number of days or months enjoined by their tenure, or the cuſtoms of the fees they held, they returned home.

Army *of obſervation*, is employed to watch and obſerve the motions of an enemy; and by beſiegers, to prevent relief being brought into a place, or the ſiege being raiſed by the enemy. See Army, in the firſt Alphabet.

ARTIFICERS, in a *military ſenſe*, are thoſe who make all kinds of fire-works, and prepare all the different ſorts of laboratory ſtores; as alſo, ſmiths, collar-makers, carpenters, wheelwrights, gun-ſmiths, lock-ſmiths, rope-makers, &c. Moſt of the foreign regiments of artillery have one company of *artificers*.

* ARX, in the *ancient military art*, implies a town, fort, caſtle, &c. for the defence of a place. The *arx*, in ancient Rome, was a diſtinct edifice from the Capitol, though ſome have confounded the two. According to Ryckius, the *arx*, properly ſpeaking, was a place on the higheſt part of the Capitoline mount, ſtronger and better fortified than the reſt, with towers and pinnated walls, in which was alſo the temple of Jupiter Capitolinus.

B

*BANDERET, in *military hiſtory*, implies the commander in chief of the troops of the canton of Bern, in Switzerland.

* BANNERS, in the *horſe equipage*, for the kettle-drums and trumpets, to be of the colour of the facing of the regiment. The badge of the regiment, or its rank, to be in the centre of the banner of the kettle-drums, as on the ſecond ſtandard. The king's cypher and crown to be on the banner of the trumpets, with the rank of the regiment in figures underneath. The depth of the kettle-drum banners to be 3 feet 6 inches; the length 4 feet 8 inches, excluding the fringe. Thoſe of trumpets to be 12 inches in depth, and 18 inches in length.

* BARBET *battery*, in *gunnery*, is when the breaſt-work of a battery is only 3 feet high, that the guns may fire over it without being obliged to make embraſures: in ſuch caſes, it is ſaid the guns fire *en barbet*. See BATTERY, in the firſt Alphabet.

* BATTLEMENTS, in *military affairs*, are the indentures in the top of old caſtles or fortified walls, or other buildings, in the form of embraſures, for the greater conveniency of firing or looking through.

BAT-*men*, } a kind of ſervants in the army,
BAW-*men*, } that take care of the baggage-horſes.

* BAT-*horſes*, } are baggage-horſes belong-
* BAW-*horſes*, } ing to the officers when on actual duty.

* BEACON, a ſignal for the better ſecuring the kingdom from foreign invaſions.

On certain eminent places of the country are placed long poles erect, whereon are faſtened pitch-barrels to be fired by night, and ſmoke made by day, to give notice, in a few hours, to the whole kingdom, of an approaching invaſion.

* BEAR, in *gunnery*. A piece of ordnance is ſaid to *bear*, or come to *bear*, when pointed directly againſt the object; that is, pointed to hit the object

BELTS, in the *army*, are of different ſorts, and for various purpoſes, viz.

Shoulder-BELTS for the dragoon-guards, horſe and dragoons, to be $4\frac{1}{2}$ inches broad; thoſe of the light dragoons to be $2\frac{1}{2}$ inches broad. Regiments that have buff waiſtcoats, are to have buff-coloured accoutrements, and thoſe which have white waiſtcoats, to have white.

Waiſt-BELTS, to be $2\frac{3}{4}$ inches broad, except thoſe of the light dragoons, which are to be $1\frac{3}{4}$ inches only; to have yellow buckles or claſps: the horſe to have *croſs belts*; the dragoon-guards and dragoons to have only one *ſhoulder-belt*, except the 8th regiment, which is permitted to wear *croſs-belts*.

BELTS are known among the ancient and middle-age writers by divers names, as *ζωνη*, *ζωνα*, *zona*, *cingulum*, *reminiculum*, *ringa*, and *baldrellus*. The *belt* was an eſſential piece of the ancient armour, inſomuch that we ſometimes find it uſed to denote the whole armour. In latter ages the *belt* was given to a perſon when he was raiſed to knighthood: whence it has alſo been uſed as a badge or mark of the knightly order.

BENDINGS, in *military and ſea matters*, are ropes, wood, &c. bent for ſeveral purpoſes. M. Amontons gives ſeveral experiments concerning the *bending* of ropes. The friction of a rope *bent*, or wound round an immoveable cylinder, is ſufficient, with a very ſmall power, to ſuſtain very great weights. Divers methods have been contrived for *bending* timber, in order to ſupply crooked planks and pieces for building ſhips; ſuch as by ſand, boiling water, ſteam of boiling water, and by fire. See M. Du Hamel, in his book called *Du Tranſport, de la Conſervation, & de la Force des Bois*. M. Deleſme ingeniouſly enough propoſed to have the young trees bent, while growing in the foreſt. The method of *bending* planks by ſand-heat, now uſed in the king's yards, was invented by captain Cumberland.

A method has been lately invented and practiſed for *bending* pieces of timber, ſo as to make the wheels of carriages without joints. The *bending* of boards, and other pieces of timber for curved works in joinery, is effected by holding them to the fire, then giving them the figure required, and keeping them in this figure by tools for the purpoſe.

BENEFICIARII, in *ancient military hiſtory*, denotes ſoldiers who attend the chief officers of the army, being exempted from all other duty.

BENEFICIARII were alſo ſoldiers diſcharged from the military ſervice or duty, and provided with *beneficia* to ſubſiſt on.

* BLOCK *battery*, in *gunnery*, a wooden battery for two or more ſmall pieces, mounted on wheels, and moveable from place to place; very ready to fire *en barbet*, in the galleries and caſemates, &c. where room is wanted.

* BLOCK-*houſe*, in the *military art*, a kind of wooden fort or fortification, ſometimes mounted on rollers, or on a flat-bottomed veſſel, ſerving either on the lakes or rivers, or in counterſcarps and counter-approaches. This name is ſometimes given to a brick or ſtone building on a bridge, or the brink of a river, ſerving not only for its defence, but for the command of the river, both above and below.

BORE. See CANNON, in the firſt Alphabet.

BRANCH *of a mine*. See MINE, in the firſt Alphabet.

BRIDGES. See BRIDGE, in the firſt Alphabet.

BRIDGES are generally placed in a direction perpendicular to the ſtream in a direct line, to give free paſſage to the water. They are made of carpentry or maſonry. The number of arches of a *bridge* is generally made odd; either that the middle of the ſtream or chief current may flow freely without interruption of a pier; or that the two halves of the *bridge*, by gradually riſing from the ends to the middle, may there meet in the higheſt and largeſt arch; or elſe, for the ſake of grace, that by being open in the middle, the eye in viewing it may look directly through there, as we always expect to do in looking at it, and without which opening we generally feel a diſappointment in viewing it.

If the *bridge* be equally high throughout, the arches, being all of a height, are made all of a ſize, which cauſes a great ſaving of centering. If the *bridge* be higher in the middle than at the ends, let the arches decreaſe from the middle towards each end, but ſo that each half have the arches exactly alike, and that they decreaſe in ſpan proportionally to their height, ſo as to be always the ſame kind of figure. *Bridges* ſhould rather be of few and large arches, than of many and ſmall ones, if the height and ſituation will allow of it.

Names of all the terms peculiar to BRIDGES, *&c.*

Abutment. See *Butments*.

Arch, an opening of a bridge, through or under which the water, &c. paſſes, and which is ſupported by piers or butments. *Arches* are denominated circular, elliptical, cycloidal, caternarian, equilibrial, gothic, &c. according to their figure or curve.

Archivolt, the curve or line formed by the upper ſides of the vouſſoirs or arch-ſtones. It is parallel to the intrados or under ſide of the arch when the vouſſoirs are all of the ſame length; otherwiſe not.

By the *archivolt* is alſo ſometimes underſtood the whole ſet of vouſſoirs.

Banquet, the raiſed foot-path at the ſides of the bridge next the parapet: it is generally raiſed about a foot above the middle or horſe-paſſage, and 3, 4, 5, 6, or 7, &c. feet broad, according to the ſize of the bridge, and paved with large ſtones, whoſe length is equal to the breadth of the walk.

Battardeau, or *Coffer-dam*, a caſe of piling, &c. without a bottom, fixed in the bed of the river, water-tight or nearly ſo, by which to lay the bottom dry for a ſpace large enough to build the pier on. When it is fixed, its ſides reaching above the level of the water, the water is pumped out of it, or drawn off by engines, &c. 'till the ſpace be dry; and it is kept ſo by the ſame means, until the pier is built up in it, and then the materials of it are drawn up again. *Battardeaux* are made in various manners, either by a ſingle incloſure, or by a double one, with clay or chalk rammed in between the two, to prevent the water from coming through the ſides: and theſe incloſures are alſo made either with piles only, driven cloſe by one another, and ſometimes notched or dove-tailed into each other; or with piles grooved in the ſides, driven in at a diſtance from one another, and boards let down between them in the grooves.

Butments, are the extremities of a bridge, by which it joins to, or abuts upon, the land, or ſides of the river, &c.

Theſe muſt be made very ſecure, quite immoveable, and more than barely ſufficient to reſiſt the drift of its adjacent arch; ſo that, if there are not rocks or very ſolid banks to raiſe them againſt, they muſt be well re-inforced with proper walls or returns, &c.

Caiſſon, a kind of cheſt, or flat-bottomed boat, in which a pier is built, then ſunk to the bed of the river, and the ſides looſened and taken off from the bottom, by a contrivance for that purpoſe; the bottom of it being left under the pier as a foundation. It is evident therefore that the bottoms of the *caiſſons* muſt be made very ſtrong and fit for the foundations of the piers. The *caiſſon* is kept afloat 'till the pier be built to the height of low-water mark; and for that purpoſe its ſides muſt either be made of more than that height at firſt, or elſe gradually raiſed to it, as it ſinks by the weight of the work, ſo as always to keep its top above water: and therefore the ſides muſt be made very ſtrong, and kept aſunder by croſs timbers within, leſt the great preſſure of the ambient water cruſh the ſides in, and ſo not only endanger the work, but alſo drown the workmen within it. The *caiſſon* is made of the ſhape of the pier, but ſome feet wider on every ſide to make room for the men to work: the whole of the ſides are of two pieces, both joined to the bottom quite round, and to each other at the ſalient angle, ſo as to be diſengaged from the bottom, and from each other, when the pier is raiſed to the deſired height, and ſunk. It is alſo convenient to have a little ſluice made in the bottom, occaſionally to open and ſhut, to ſink the *caiſſon* and pier ſometimes by, before it be finiſhed, to try if it bottom level and rightly; for by opening the ſluice, the water will ruſh in and fill it to the height of the exterior water, and the weight of the work already built will ſink it; then by ſhutting the ſluice again, and pumping out the water, it will be made to float again, and the reſt of the work may be completed; but it muſt not be ſunk but when the ſides are high enough to reach above the ſurface of the water, otherwiſe it cannot be raiſed and laid dry again. Mr. Labelye tells us, that the *caiſſons* in which he built Weſtminſter bridge, contained above 150 load of fir timber, of 40 cubic feet each, and was of more tonnage or capacity than a 40-gun ſhip of war.

Centres, are the timber frames erected in the ſpaces of the arches to turn them on, by building on them the vouſſoirs of the arch. As the *centre* ſerves as a foundation for the arch to be built on, when the arch is completed, that foundation is ſtruck from under it, to make way for the water and navigation, and then the arch will ſtand of itſelf from its curved figure. The *centre* muſt be conſtructed of the exact figure of the intended arch, convex as the arch is concave, to receive it on as a mould. If the form be circular, the curve is ſtruck from a central point by a radius; if it be elliptical, it ſhould be ſtruck with a double cord, paſſing over two pins fixed in the focuſſes, as the mathematicians deſcribe their ellipſes; and not by ſtriking different pieces or arcs of circles from ſeveral *centres*; for theſe will form no ellipſis at all, but an irregular miſſhapen curve made up of broken pieces of different circular arches; but if the arch be of any other form, the ſeveral abſciſſas and ordinates ſhould be calculated; then their correſponding lengths, transferred to the centering, will give ſo many points of the curve, and exactly by which points bending a bow of pliable matter, the curve may be drawn by it.

The *centres* are conſtructed of beams of timber, firmly pinned and bound together, into one entire compact frame, covered ſmooth at top with planks or boards to place the vouſſoirs on; the whole ſupported by off-ſets in the ſides of the piers, and by piles driven into the bed of the river, and capable of being raiſed and depreſſed by wedges contrived for that purpoſe, and for taking them down when the arch is completed. They ſhould alſo be conſtructed of a ſtrength more than ſufficient to bear the weight of the arch.

In taking the *centre* down, firſt let it down a little, all in a piece, by eaſing ſome of the wedges; then let it reſt a few days to try if the arch makes any efforts to fall, or any joints open, or any ſtones cruſh or crack, &c. that the damage may be repaired before the *centre* is entirely removed, which is not to be done 'till the arch ceaſes to make any viſible efforts.

Cheſt. See *Caiſſon*.

Cofferdam. See *Battardeau*.

Drift, *Shoot*, or *Thruſt*, } of an arch, is the puſh or force which it exerts in the direction of the length of the bridge. This force ariſes from the perpendicular gravitation of the ſtones of the arch, which being kept from deſcending by the form of the arch, and the reſiſtance of the pier, exert their force in a lateral or horizontal direction. This force is computed in *Prop.* 10, of Mr. Hutton's *Principles of Bridges*, where the thickneſs of the pier is determined that is neceſſary to reſiſt it, and is greater the lower the arch is, *cæteris paribus*.

Elevation, the orthographic projection of the front of a bridge, on the vertical plane, parallel to its length. This is neceſſary to ſhow the form and dimenſions of the arches and other parts, as to height and breadth, and therefore has a plain ſcale annexed to it, to meaſure the parts by. It alſo ſhows the manner of working up and decorating the fronts of the bridge.

Extrados, the exterior curvature or line of an arch. In the propoſitions of the ſecond ſection in Profeſſor Hutton's *Principles of Bridges*, it is the outer or upper line of the wall above the arch; but it often means only the upper or exterior curve of the vouſſoirs.

Foundations, the bottoms of the piers, &c. or the baſes on which they are built. Theſe bottoms are always to be made with projections, greater or leſs, according to the ſpaces on which they are built: and according to the nature of the ground, depth and velocity of water, &c. the foundations are laid and the piers built after different manners, either in caiſſons, in battardeaux, on ſtilts with ſterlings, &c. for the particular method of doing which, ſee each under its reſpective term.

The moſt obvious and ſimple method of laying the *foundations* and raiſing the piers up to the water-mark, is to turn the river out of its courſe above the place of the bridge, into a new channel cut for it near the place where it makes an elbow or turn; then the piers are built on dry ground, and the water turned into its old courſe again, the new one being ſecurely banked up. This is certainly the beſt method, when the new channel can be eaſily and conveniently made; but which however is ſeldom or never the caſe.

Another method is, to lay only the ſpace of each pier dry 'till it be built, by ſurrounding it with piles and planks driven down into the bed of the river, ſo cloſe together as to exclude the water from coming in; then the water is pumped out of the incloſed ſpace, the pier built in it, and laſtly the piles and planks drawn up. This is coffer-dam work, but evidently cannot be practiſed if the bottom be of a looſe conſiſtence, admitting the water to ooze and ſpring up through it.

When neither the whole nor part of the river can be eaſily laid dry as above, other methods are to be uſed; ſuch as to build either in caiſſons or on ſtilts, both which methods are deſcribed under their proper words; or yet by another method, which hath, though ſeldom, been ſometimes uſed, without laying the bottom dry, and which is thus: the pier is built upon ſtrong rafts or gratings of timber, well bound together, and buoyed up on the ſurface of the water by ſtrong cables, fixed to the other floats or machines, 'till the pier is built; the whole is then gently let down to the bottom, which muſt be made level for the purpoſe: but of theſe methods, that of building in caiſſons is the beſt.

But before the pier can be built in any manner, the ground at the bottom muſt be well ſecured, and made quite good and ſafe, if it be not ſo naturally. The ſpace muſt be bored into, to try the conſiſtence of the ground; and if a good bottom of ſtone, or firm gravel, clay, &c. be met with, within a moderate depth below the bed of the river, the looſe ſand, &c. muſt be removed and digged out to it, and the foundation laid on the firm bottom on a ſtrong grating or baſe of timber made much broader every way than the pier, that there may be the greater baſe to preſs on, to prevent its being ſunk; but if a ſolid bottom cannot be found at a convenient depth to dig to, the ſpace muſt then be driven full of ſtrong piles, whoſe tops muſt be ſawed off level ſome feet below the bed of the water, the ſand having been previouſly digged out for that purpoſe; and then the foundation on a grating of timber laid on their tops as before: or, when the bottom is not good, if it be made level, and a ſtrong grating of timber, 2, 3, or 4 times as large as the baſe of the pier be made, it will form a good baſe to build on, its great ſize preventing it from ſinking. In driving the piles, begin at the middle, and proceed outwards all the way to the borders or margin; the reaſon of which is, that if the outer ones were driven firſt, the earth of the inner ſpace would be thereby ſo jammed together, as not to allow the inner piles to be driven: and beſides the piles immediately under the piers, it is alſo very prudent to drive in a ſingle, double, or triple row of them around, and cloſe to the frame of the *foundation*, cutting them off a little above it, to ſecure it from ſlipping aſide out of its place, and to bind the ground under the pier firmer: for, as the ſafety of the whole bridge depends on the *foundation*, too much care cannot be uſed to have the bottom made quite ſecure.

Jettee, the border made round the ſtilts under a pier. See *Sterling*.

Impoſt, is the part of the pier on which the feet of the arches ſtand, or from which they ſpring.

Key-ſtone, the middle vouſſoir, or the arch-ſtone in the top or immediately over the centre of the arch. The length of the *key-ſtone*, or thickneſs of the archivolt at top, is allowed to be about 1-15th or 1-16th of the ſpan by the beſt architects.

Orthography, the elevation of a bridge, or front view, as ſeen at an infinite diſtance.

Parapet, the breaſt-wall made on the top of a bridge to prevent paſſengers from falling over. In good bridges, to build the parapet but a little part of its height cloſe or ſolid, and upon that a baluſtrade to above a man's height, has an elegant effect.

Piers, the walls built for the ſupport of the arches, and from which they ſpring as their baſes. They ſhould be built of large blocks of ſtone, ſolid throughout, and cramped together with iron, which will make the whole as one ſolid ſtone. Their faces or ends, from the baſe up to high-water mark, ſhould project ſharp out with a ſalient angle, to divide the ſtream: or, perhaps the bottom of the pier ſhould be built flat or ſquare up to about half the height of low-water mark, to allow a lodgement againſt it for the ſand and mud, to go over the foundation; leſt, by being kept bare, the water ſhould in time undermine, and ſo ruin or injure it. The beſt form of the projection for dividing the ſtream, is the triangle; and the longer it is, or the more acute the ſalient angle, the better it will divide it, and the leſs will the force of the water be againſt the pier; but it may be ſufficient to make that angle a right one, as it will make the work ſtronger; and in that caſe the perpendicular projection will be equal to half the breadth or thickneſs of the pier. In rivers, on which large heavy craft navigate and paſs the arches, it may perhaps be better to make the ends ſemicircular; for, although it does not divide the water ſo well as the triangle, it will both better turn off and bear the ſhock of the craft.

The thickneſs of the *piers* ſhould be ſuch as will make them of weight or ſtrength ſufficient to ſupport their interjacent arch independent of any other arches; and then, if the middle of the *pier* be run up to its full height, the centering may be ſtruck to be uſed in another arch before the hanches are filled up. The whole theory of the *piers* may be ſeen in the third ſection of Profeſſor Hutton's *Principles of Bridges.*

They ſhould be made with a broad bottom on the foundation, and gradually diminiſhing in thickneſs by off-ſets up to low-water mark.

Piles, are timbers driven into the bed of the river for various purpoſes, and are either round, ſquare, or flat like planks. They may be of any wood which will not rot under water; but oak and fir are moſtly uſed, eſpecially the latter, on account of its length, ſtraightneſs, and cheapneſs. They are ſhod with a pointed iron at the bottom, the better to penetrate into the ground, and are bound with a ſtrong iron-band or ring at top, to prevent them from being ſplit by the violent ſtrokes of the ram by which they are driven down.

Piles are either uſed to build the foundations on, or they are driven about the pier as a border of defence, or to ſupport the centres on; and in this caſe, when the centering is removed, they muſt either be drawn up, or ſawed off very low under water; but it is perhaps better to ſaw them off and leave them ſticking in the bottom, leſt the drawing of them out ſhould looſen the ground about the foundation of the pier. Thoſe to build on, are either ſuch as are cut off by the bottom of the water, or rather a few feet within the bed of the river; or elſe ſuch as are cut off at low-water mark, and then they are called ſtilts. Thoſe to form borders of defence, are rows driven in cloſe by the frame of a foundation, to keep it firm, or elſe they are to form a caſe or jettée about the ſtilts, to keep the ſtones within it, that are thrown in to fill it up: in this caſe the *piles* are grooved, driven at a little diſtance from each other, and *plank-piles* let into the grooves between them, and driven down alſo, 'till the whole ſpace is ſurrounded. Beſides uſing this for ſtilts, it is ſometimes neceſſary to ſurround a ſtone pier with a ſterling, or jettée, and fill it up with ſtones to ſecure an injured pier from being ſtill more damaged, and the whole bridge ruined. The *piles* to ſupport the centres may alſo ſerve as a border of piling to ſecure the foundation, cutting them off low enough after the centre is removed.

Pile-driver, an engine for driving down the piles. It conſiſts of a large ram or iron ſliding perpendicularly down between two guide-poſts; which being lifted up to the top of them, and there let fall from a great height, comes down upon the top of the pile with a violent blow. It is worked either with men or horſes, and either with or without wheel-work. That which was uſed at the building of Weſtminſter bridge, is perhaps the beſt ever invented.

Pitch, of an arch, the perpendicular height from the ſpring or impoſt to the key-ſtone.

Plan, of any part, as of the foundations, or piers, or ſuperſtructure, is the orthographic projection of it on a plane parallel to the horizon.

Puſh, of an arch. See *Drift.*

Salient angle, of a pier, the projection of the end againſt the ſtream, to divide it. The right-lined angle beſt divides the ſtream, and the more acute, the better for that purpoſe; but the right angle is generally uſed, as making the beſt maſonry. A ſemicircular end, though it does not divide the ſtream ſo well, is ſometimes better in large navigable rivers, as it carries the craft the better off, or bears their ſhocks the better.

Shoot, of an arch. See *Drift*.

Springers, are the firſt or loweſt ſtones of an arch, being thoſe at its feet, bearing immediately on the impoſt.

Sterlings, or *Jettées*, a kind of caſe made about a pier of ſtilts, &c. to ſecure it, and is particularly deſcribed under the next word, *Stilts*.

Stilts, a ſet of piles driven into the ſpace intended for the pier, whoſe tops being ſawed level off, above low-water mark, the pier is then raiſed on them. This method was formerly uſed when the bottom of the river could not be laid dry; and the ſe *ſtilts* were ſurrounded, at a few feet diſtance, by a row of piles and planks, &c. cloſe to them like a coffer-dam, and called a *ſterling*, or *jettée*; after which looſe ſtones, &c. are thrown or poured down into the ſpace, 'till it is filled up to the top, by that means forming a kind of pier of rubble or looſe work, and which is kept together by the ſides or ſterlings: this is then paved level at the top, and the arches turned upon it. This method was formerly much uſed, for moſt of the large old bridges in England being erected that way, ſuch as London bridge, Newcaſtle bridge, Rocheſter bridge, &c. But the inconveniences attending it are ſo great, that it is now quite diſuſed: for, becauſe of the looſe compoſition of the piers, they muſt be made very large or broad, or elſe the arch muſt puſh them over, and ruſh down as ſoon as the centre was drawn; which great breadth of piers and ſterlings ſo much contracts the paſſage of the water, as not only very much incommodes the navigation through the arch, from the fall and quick motion of the water; but from the ſame cauſe alſo the bridge itſelf is in much danger, eſpecially in time of floods, when the water is too much for the paſſage. Add to this, that beſides the danger there is of the pier burſting out the ſterlings, they are alſo ſubject to much decay and damage by the velocity of the water and the craft paſſing through the arches.

Thruſt. See *Drift*.

Vouſſoirs, the ſtones which immediately form the arch, their underſides conſtituting the intrados. The middle one, or key-ſtone, ſhould be about 1-15th or 1-16th of the ſpan, as has been obſerved; and the reſt ſhould increaſe in ſize all the way down to the impoſt: the more they increaſe the better, as they will the better bear the great weight which reſts upon them without being cruſhed; and alſo will bind the firmer together. Their joints ſhould alſo be cut perpendicular to the curve of the intrados.

For more information ſee Profeſſor Hutton's *Principles of Bridges*, Newcaſtle, 1772, in 8°.

* BRIGANDINE, in *ancient military hiſtory*, a coat of mail, or kind of ancient defenſive armour, conſiſting of tin.

BUCKLER, in *antiquity*, a piece of defenſive armour uſed by the ancients. It was always worn on the left arm, and compoſed of wicker-work, of the lighteſt ſort, but moſt commonly of hides, fortified with plates of braſs or other metals. The ſhape of it varied conſiderably, being ſometimes round, ſometimes oval, and often nearly ſquare.

BUDGE-*barrels*. See BARRELS, in the firſt Alphabet.

BUFF. See BELTS, in the firſt Alphabet.

* BUILDING, in a *general ſenſe*, a fabric erected by art, either for devotion, magnificence, or conveniency.

Military BUILDINGS, are of various ſorts, viz. powder-magazines, bridges, gates, barracks, hoſpitals, ſtore-houſes, guard-rooms, &c.

Regular BUILDING, is that whoſe plan is ſquare, the oppoſite ſides equal, and all the parts diſpoſed with ſymmetry.

Irregular BUILDING, that whoſe plan is not contained within equal or parallel lines, either by the accident of ſituation, or the deſign of the builder, and whoſe parts are not relative to one another in the elevation.

Inſulated BUILDING, that which is not contiguous to any other, but is encompaſſed with ſtreets, open ſquares, or the like.

Engaged BUILDING, one ſurrounded with other buildings, having no front to any ſtreet or public place, nor any communication without, but by a common paſſage.

Interred or *ſunk* BUILDING, one whoſe area is below the ſurface of the place where it ſtands, and of which the loweſt courſes of ſtone are concealed.

In *building* there are three things to be conſidered, viz. firſt, commodity or conveniency; ſecondly, firmneſs or ſtability; thirdly, delight.

To accompliſh which ends, Sir Henry Wotton conſiders the whole ſubject under two heads, namely, the ſeat or ſituation, and the work.

1. As for the ſeat, either that of the whole is to be conſidered, or that of its parts.

2. As to the ſituation, regard is to be had to the quality, temperature, and ſalubrity or healthineſs of the air; that it be a good healthy air, not ſubject to foggy noiſomeneſs from adjacent fens or marſhes; alſo free from noxious mineral exhalations; nor ſhould the place want

the ſweet influence of the ſun-beams, nor be wholly deſtitute of the breezes of wind, which will fan and purge the air; the want of which would render it like a ſtagnated pool, and would be very unhealthy.

In the foundations of *buildings*, Vitruvius orders the ground to be dug up, to examine its firmneſs; that an appearing ſolidity is not to be truſted, unleſs the whole mould cut through be ſound and ſolid: 'tis true, he does not ſay to what depth it ſhould be dug; but Palladio determines it to be a ſixth part of the height of the building.

The great laws of walling are, 1. That the walls ſtand perpendicular on the ground-work, the right angle being the foundation of all ſtability. 2. That the largeſt and heavieſt materials be the loweſt, as more proper to ſuſtain others than be ſuſtained themſelves. 3. That the work diminiſh in thickneſs, as it riſes, both for the eaſe of weight and expence. 4. That certain courſes, or ledges, of more ſtrength than the reſt, be interlaid, like bones, to ſuſtain the wall from total ruin, if ſome of the under parts chance to decay. 5. Laſtly, that the angles be firmly bound, they being the nerves of the whole fabric; which are ſometimes fortified on each ſide the corners, even in brick buildings, with ſquare ſtones; which add both beauty and ſtrength. See STONE, BRICKS, LIME, SAND.

C

*CIMENT, CEMENT, } *among engineers*, a ſtrong ſort of mortar, uſed to bind bricks or ſtones together for ſome kind of mouldings; or in cementing a block of bricks for the carving of capitals, ſcrolls, or the like. There are two ſorts, i. e. hot *cement*, which is the moſt common, made of reſin, bees-wax, brick-duſt, and chalk, boiled together. The bricks to be cemented with this mixture, muſt be made hot in the fire, and rubbed to and fro after the *cement* is ſpread, in the ſame manner as joiners do when they glue two boards together. Cold *cement*, made of Cheſhire cheeſe, milk, quick lime, and whites of eggs. This *cement* is leſs uſed than the former, and is accounted a ſecret known but to very few bricklayers.

* CÆSTUS, in *military antiquity*, a kind of large gauntlet, compoſed of raw hides, uſed by wreſtlers at the public games.

CAIMACAN, in *military hiſtory*, an officer among the Turks, nearly anſwering to our lieutenant.

CAMP. See the firſt Alphabet.

The arrangement of the tents in *camp*, is nearly the ſame all over Europe, which is, to diſpoſe them in ſuch a manner, that the troops may form with ſafety and expedition.

To anſwer this end, the troops are encamped in the ſame order as that in which they are to engage, which is by battalions and ſquadrons; hence, the poſt of each battalion and ſquadron in the line of battle, muſt neceſſarily be at the head of its own encampment. Guſtavus Adolphus, king of Sweden, was the firſt who formed encampments according to the order of battle.

By this diſpoſition, the extent of the *camp* from right to left, of each battalion and ſquadron, will be equal to the front of each in line of battle; and conſequently, the extent from right to left of the whole *camp*, ſhould be equal to the front of the whole army when drawn up in line of battle, with the ſame intervals between the ſeveral encampments of the battalions and ſquadrons, as are in the line.

There is no fixed rule for the intervals: ſome will have no intervals, ſome ſmall ones, and others are for intervals equal to the front of the battalion or ſquadron. The moſt general method is, an interval of 60 feet between each battalion, and of 36 feet between each ſquadron.

Hence it follows, 1ſt, That the front line of the *camp* be in a direction to face the enemy; 2dly, That at the head of the encampment of each battalion and ſquadron, there muſt be a clear ſpace of ground, on which they may form in line of battle; and 3dly, That when the ſpace taken up by the army is embarraſſed with woods, ditches, and other obſtructions, a communication muſt be opened for the troops to move with eaſe to the aſſiſtance of each other.

The *camps* of the Greeks and Romans were either round, ſquare, or oval, or rather of an oblong ſquare, with the ſharp corners taken off; and to ſecure them againſt ſurpriſes, it was the prevailing cuſtom to ſurround them with intrenchments. The *camps* of the Anglo-Saxons and Danes were generally round, as likewiſe thoſe of the Anglo-Normans. The *camps* of the ancient Britons were of an oval form, compoſed of ſtakes, earth, and ſtones, rudely heaped together: but the practice of the preſent times is quite different; for the ſecurity of our *camps*, whoſe form is a rectangle, conſiſts in being able to draw out the troops with eaſe and expedition at the head of their reſpective encampments.

Camp *of a battalion of infantry*, is the ground on which they pitch their tents and lodges.

The principal object in the arrangement of a *camp* is, that both officers and men may repair with facility and expedition to the head of the line; for which reaſon the tents are placed in rows perpendicular to the front of the camp, with ſpaces between them, called ſtreets. The general method is, to form as many rows of tents as there are companies in the battalion; thoſe for the private men in the front, and thoſe for the officers in the rear. See Pl. VIII.

The ſeveral companies of a battalion are poſted in camp, in the ſame manner as in the line of battle; that is, the company of grenadiers on the right, and that of light-infantry on the left; the colonel's company on the left of the grenadiers, the lieutenant-colonel's on the right of the light-infantry, the major's on the left of the colonel's, the eldeſt captain's on the right of the lieutenant-colonel's; and ſo on from right to left, 'till the two youngeſt companies come into the centre.

The battalion companies are poſted two by two; that is, the tents of every two of theſe companies are ranged cloſe together, to obtain, though fewer, larger and more commodious ſtreets: the entrances of all the companies tents face the ſtreets, except the firſt tent of each row belonging to the ſerjeants, which faces the bells of arms and front of the camp.

The number of tents in each perpendicular row, is regulated by the ſtrength of the companies, and the number of men allowed to each tent, which at preſent is 5 men: thence it follows, that a company of 60 men will require 12 tents, a company of 75 men 15 tents, and a company of 100 men 20 tents; but as it always happens that ſome are on duty, fewer tents may ſerve in time of neceſſity.

When the battalion is in the firſt line of encampment, the privies are opened in the front, and at leaſt 150 feet beyond the quarter-guard; and when in the ſecond line, they are opened in the rear of that line.

To diſtinguiſh the regiments, camp colours are fixed at the flanks, and at the quarter and rear guard.

The colours and drums of each battalion are placed at the head of its own grand ſtreet, in a line with the bells of arms of the ſeveral companies. The officers eſpontoons are placed at the colours, with the broad part of their ſpears to the front. The ſerjeants halberts are placed between, and on each ſide of the bells of arms, with their hatchets turned from the colours.

When two field-pieces are allowed to each battalion, they are poſted to the right of it. Guſtavus Adolphus, king of Sweden, was the firſt who ordered two field-pieces to each battalion, which are generally light 6-pounders.

Diſtribution of the front and depth of the Camp *for a battalion of infantry.* The preſent mode of encampments differs from what they formerly were. The front of the *camp* for a battalion of 10 companies of 60 men each, is at preſent 400 feet, and during the late wars only 360 feet; the depth at preſent 759 feet, and during the late war 960. The front of the *camp* of a battalion of 10 companies of 100 men each is at preſent 668 feet, and formerly only 592; the depth 759 feet, formerly 960. The breadth of the ſtreets from 45 to 55 feet, excepting the main ſtreet, which is ſometimes from 60 to 90 feet broad.

Of the Camp *of a battalion by a new method.* This is, by placing the tents in 3 rows parallel to the principal front of the *camp*; that is, ſuitable to the 3 ranks in which the battalion is drawn up: the tents of the firſt row, which front the *camp*, are for the men of the front rank: the tents of the ſecond row front the rear, and are for the men of the ſecond rank; and the tents of the third row, which front the centre row, are for the men of the rear rank.

Camp *of cavalry.* The tents for the cavalry, as well as for the infantry, are placed in rows perpendicular to the principal front of the *camp*; and their number is conformable to the number of troops. The horſes of each troop are placed in a line parallel to the tents, with their heads towards them. See Pl. IX.

The number of tents in each row, is regulated by the ſtrength of the troops, and the number of troopers allotted to each tent is 5: it follows that a troop of 30 men will require 6 tents, a troop of 60 men 12 tents, and a troop of 100 men 20 tents. The tents for the cavalry are of the ſame form as thoſe of the infantry, but more ſpacious, the better to contain the fire-arms, accoutrements, ſaddles, bridles, boots, &c. See TENTS.

Diſtribution of the front and depth of a CAMP *of cavalry*. Suppoſing the regiment to conſiſt of 2 ſquadrons, of 3 troops each, and of 50 men in each troop, the extent of the front will be 450 feet, if drawn up in 2 ranks; but if drawn up in 3 ranks, the front will be only 300 feet, the depth 220, and the breadth of the back ſtreets 30 feet, and the other ſtreets 46 feet each. In the laſt war 600 feet were allowed each regiment of cavalry in front, 774 feet for the depth, and the breadth of the ſtreets as above.

The ſtandard-guard tents are pitched in the centre, in a line with the quarter-maſter's. The camp colours of the cavalry are alſo of the ſame colour as the facing of the regiment, with the rank of the regiment in the centre: thoſe of the horſe are ſquare, like thoſe of the foot; and thoſe of the dragoons are ſwallow-tailed. The dung of each troop is laid up behind the horſes. See Pl. IX.

CAMP *duty*, conſiſts in guards, both ordinary and extraordinary: the ordinary guards are relieved regularly at a certain hour every day (generally about 9 or 10 o'clock in the morning); the extraordinary guards are all kinds of detachments commanded on particular occaſions for the further ſecurity of the *camp*, for covering the foragers, for convoys, eſcorts, or expeditions.

The ordinary guards are diſtinguiſhed into grand guards, ſtandard, and quarter guards; rear guards, picket guards, and guards for the general officers; train of artillery, bread waggons, pay-maſter general, quarter-maſter general, majors of brigade, judge advocate, and provoſt marſhal. See GUARDS, in the firſt Alphabet.

The number and ſtrength of the grand guards and out-poſts, whether of cavalry or infantry, depend on the ſituation of the *camp*, nature of the country, and the poſition of the enemy. The ſtrength of general officers guards is limited. See HONOURS, in the firſt Alphabet.

CAMP *maxims*, are, 1. The principal rule in forming a *camp*, is to give it the ſame front the troops occupy in order of battle.

2. The method of encamping is by battalions and ſquadrons, except the royal regiment of artillery, which is encamped on the right and left of the park of artillery. See ARTILLERY PARK, and *Encampment of a regiment of artillery*, in the firſt Alphabet.

3. Each man is allowed 2 feet in the ranks of the battalion, and 3 feet in the ſquadron: thence the front of a battalion of 900 men, formed 3 deep, will be 600 feet; and the front of a ſquadron of 150 men, formed 2 deep, will be 225 feet.

4. The depth of the *camp* when the army is encamped in 3 lines, is at leaſt 2750 feet; that is, 750 feet for the depth of each line, and 250 feet for the ſpace between each of thoſe lines.

5. The park of artillery ſhould always be placed on a dry riſing ground, if any ſuch ſituation offers; either in the centre of the front line, or in the rear of the ſecond line; with all the train horſes encamped in the rear of the park. See Pl. II.

6. The bread-waggons ſhould be ſtationed in the rear of the *camp*, and as near as poſſible to the centre, that the diſtribution of the bread may be rendered eaſy.

7. When the commander in chief encamps, it is generally in the centre of the army; and the town or village choſen for his reſidence is called head quarters.

8. That general is inexcuſable, who, for his own perſonal accommodation, makes choice of quarters that are not properly ſecured, or at too great a diſtance to have an eaſy communication with the *camp*.

9. If the ground permits, the troops ſhould be encamped as near to good water as poſſible.

10. When there are huſſars, they are generally poſted near the head quarters, or in the front of the army.

11. The ground taken up by the encampment of an army, ſhould be equally diſtributed, and, if poſſible, in a ſtraight line; for then the whole will have more grace: for a crooked line, and an inequality of diſpoſition, afford a very unpleaſing view both of the camp, and of the troops when they are under arms.

12. Cleanlineſs is eſſentially neceſſary to the health of a *camp*, eſpecially when it is to remain for any length of time. To maintain this, the privies ſhould be often filled up, and others opened; at leaſt every 6 days. The offal of cattle, and the carcaſſes of dead horſes, ſhould be buried very deep; and all kinds of corrupt effluvia, that may infect the air and produce epidemical diſorders, ſhould be conſtantly removed.

Choice of CAMPS. 1. At the beginning of

a

a campaign, when the enemy is at too great a diſtance to occaſion any alarm, all ſituations for *camps* that are healthy are good, provided the troops have room, and within reach of water, wood, and proviſions. More ground ſhould be allowed to the troops in *camps* of duration, than in temporary ones.

2. *Camps* ſhould be ſituated as near as poſſible to navigable rivers, to facilitate the conveyance of all manner of ſupplies; for convenience and ſafety are the principal objects for *camps*.

3. A *camp* ſhould never be placed too near heights, from whence the enemy may overlook it; nor too near woods, from whence the enemy may ſurpriſe it. If there are eminences, not commanded by others, they ſhould be taken into the *camp*; and when that cannot be done, they ſhould be fortified.

4. The choice of a *camp* depends in a great meaſure on the poſition of the enemy, on its ſtrength, and on the nature and ſituation of the country.

5. A ſkilful general will avail himſelf of all the advantages for a *camp*, which nature may preſent, whether in plains, mountains, ravins, hollows, woods, lakes, incloſures, rivers, rivulets, &c.

6. The diſpoſition of the troops in *camp* ſhould depend on the nature and ſituation of the ground; as there are occaſions which require all the infantry to encamp on the right, and the cavalry on the left; and there are others which require the cavalry to form in the centre, and the infantry on the wings.

7. A *camp* ſhould never be formed on the banks of a river, without a ſpace of at leaſt 2 or 3000 feet, for drawing out the army in order of battle: the enemy cannot then eaſily alarm the *camp*, by artillery and ſmall arms from the other ſide.

8. *Camps* ſhould never be ſituated near rivers that are ſubject to be overflowed, either by the melting of the ſnow, or by accidental torrents from the mountains. Marſhy grounds ſhould alſo be avoided, on account of the vapours ariſing from ſtagnant water, which infect the air.

9. On the choice of *camps* and poſts, frequently depends the ſucceſs of a campaign, and even ſometimes of a war.

CAMP *guards*. They are of two ſorts; the one ſerve to maintain good order within the *camp*; and the other, which are ſtationed without the *camp*, ſerve to cover and ſecure it againſt the enemy. Theſe guards are formed of both infantry and cavalry; and in proportion to the ſtrength of the army, ſituation of the *camp*, and diſpoſition of the enemy, ſome require that theſe guards ſhould conſiſt of the 8th part of the army; others, of the 3d part; and when an attack from the enemy is apprehended, even of the half.

Manner of ſtationing the CAMP *guards*. It is of the utmoſt conſequence to ſtation the guards in ſuch places, as may enable them to diſcover eaſily whatever approaches the *camp*.

2. The guards of the cavalry are generally removed further from the *camp*, than thoſe of the infantry; but never at ſo great a diſtance, as to endanger their being cut off: within cannon-ſhot is a very good diſtance. They are often ſtationed in highways, in open places, and on ſmall heights; but, however, ſo diſpoſed, as to ſee and communicate with one another.

3. The vedettes to the out-poſts ſhould be double; for, ſhould they make a diſcovery, one may be detached to inform the officer commanding the out-poſt, and the other remain on duty: they ſhould not be at too great a diſtance from their detachment; probably, about 50 or 60 paces is enough.

4. The guards of infantry have different objects, and are differently ſtationed: their duty is, to receive and ſupport the guards of cavalry in caſe of need; to protect the troops ſent out for wood, forage, or water; in ſhort, to prevent any approaches from the ſmall parties of the enemy. Some are ſtationed in the churches of the neighbouring villages, in caſtles, houſes, and in paſſages and avenues of woods; others are ſtationed on the borders of rivulets, and in every place neceſſary to ſecure the *camp*. Guards that are ſtationed in churches, ſteeples, trees, caſtles, and houſes, ſhould if poſſible be ſeen from the army, or at leaſt from ſome grand guard in its neighbourhood, that ſignals may be ſeen and repeated.

5. The guards of infantry are generally fixed; that is, they have the ſame poſt both day and night, except ſuch as are to ſupport and protect the guards of cavalry, and to cover the forage grounds. All out-guards ſhould have intrenching-tools with them.

6. The guards of cavalry have generally a day poſt and a night poſt; the latter is ſeldom more than 4 or 500 paces from the *camp*; one third ſhould be mounted, one third bridled, and one third feeding their horſes; but when near the enemy, the whole guard ſhould be kept mounted during the night.

7. The ſecurity and tranquillity of a *camp* depending upon the vigilance of the guards, the officers who command them cannot be too active in preventing ſurpriſes: a neglect in this particular is often of fatal conſequence. Though an officer ſhould, at all times, be ſtrictly attentive to every part of the ſervice, yet he ſhould be more particularly watchful in the night than in the day. The night is the time moſt favourable for ſurpriſes; as thoſe who are not on duty, are generally aſleep, and cannot immediately afford aſſiſtance; but in the day time, the attention of all the troops is turned to the movements of the enemy; they are ſooner under arms, ſooner in readineſs to march, and in much leſs danger of being thrown into confuſion. Thoſe who wiſh to be better acquainted with the nature and mode of encampments, may read Mr. Lochée's uſeful *Eſſay on Caſtrametation.* [*]

Concerning the healthineſs of the different ſeaſons of a campaign, the ingenious Dr. Pringle has the following obſervations. The firſt 3 weeks is always ſickly; after which the ſickneſs decreaſes, and the men enjoy a tolerable degree of health throughout the ſummer, unleſs they get wet clothes. The moſt ſickly part of the campaign is towards the end of Auguſt, whilſt the days are ſtill hot, but the nights cold and damp with fogs and dews; then, if not ſooner, the dyſentery prevails; and though its violence is over by the beginning of October, yet the remitting fever, gaining ground, continues throughout the reſt of the campaign, and never entirely ceaſes, even in winter quarters, 'till the froſt begins. He likewiſe obſerves, that the laſt 14 days of a campaign, if protracted 'till the beginning of November, is attended with more ſickneſs than the two firſt months of the encampment. As to winter expeditions, though ſevere in appearance, he tells us, they are attended with little ſickneſs, if the men have ſtrong and good ſhoes, warm quarters, fuel, and proviſions enough.

CANNONADE, in *artillery*, may be defined the application of artillery to the purpoſes of a land war, or the direction of its efforts againſt ſome diſtant object intended to be ſeized or deſtroyed, as the troops in battle, battery, fortreſs, or out-work.

Cannonading is therefore uſed from a battery, to take, deſtroy, burn, or drive the enemy from the defences, &c. and to batter and ruin the works or fortified towns.

CANNON. See this word in the firſt Alphabet.

Dimenſions of all ſorts of braſs CANNON, *as eſtabliſhed by the board of ordnance in* 1764.

Nature		Pders.	Length		Weight			Calibre of the gun	Diam. of the ſhot
			F.	in.	C.	q.	lb.	in. hun.	in. hun.
Braſs guns	Heavy	42	9	6	61	0	0	7.3	6.68
		24	9	6	52	0	0	5.83	5.54
		12	9	0	29	0	0	4.63	4.40
		9	9	0	26	0	0	4.21	4.0
		6	8	0	19	0	0	3.66	3.48
		3	7	0	11	2	0	2.91	2.77
		1½	6	0	5	2	0	2.31	2.20
	Mediums	24	8	0	40	1	21	5.83	5.54
		12	6	6	21	0	14	4.63	4.40
		6	5	0	10	1	0	3.66	3.48
	Light	24	5	6	16	1	12	5.83	5.54
		12	5	0	8	3	18	4.63	4.40
		6	4	6	4	3	14	3.66	3.48
		3	3	6	2	3	4	2.91	2.77

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[*] This gentleman keeps a military academy at Little Chelſea, where youth are well inſtructed in the military ſciences and diſcipline, requiſite for the infantry and cavalry. He is deſervedly patroniſed by his Majeſty, and his mode of education has met with the approbation of the moſt ſkilful officers.

Dimenſions of all ſorts of iron CANNON, *eſtabliſhed,* 1764.

Nature	Pdrs.	Length		Weight			Calibre of the gun	Diam. of the ſhot
		F.	in.	C.	q.	lb.	in. hun.	in. hun.
Iron guns	42	9	6	65	0	0	7.3	6.68
	32	9	6	55	0	0	6.42	6.10
	24	9	6	49	0	0	5.83	5.54
	24	9	6	47	2	0	5.83	5.54
	18	9	0	40	0	0	5.29	5.3
	12	9	0	32	2	0	4.63	4.40
	12	8	6	31	2	0	4.63	4.40
	12	7	6	29	1	0	4.63	4.40
	9	9	0	29	0	0	4.21	4.0
	9	8	6	27	2	0	4.21	4.0
	9	8	0	26	2	0	4.21	4.0
	9	7	6	24	2	0	4.21	4.0
	9	7	0	23	0	0	4.21	4.0
	6	9	0	24	0	0	3.66	3.48
	6	8	6	23	0	0	3.66	3.48
	6	8	0	22	0	0	3.66	3.48
	6	7	6	20	2	0	3.66	3.48
	6	7	0	19	0	0	3.66	3.48
	6	6	6	18	0	0	3.66	3.48
	6	6	0	16	2	0	3.66	3.48
	4	6	0	12	1	0	3.21	3.4
	4	5	6	11	1	0	3.21	3.4
	3	4	6	7	1	0	2.91	2.77
	½	3	0	1	1	25	1.58	1.52

To lay a CANNON *to a given object.* Firſt find the centre of metal by the perpendicular, then apply your two fore fingers to the baſe centre, and look behind them until you make the muzzle centre cut the centre of the object; then the piece is properly directed. Secondly, having determined upon the neceſſary elevation, place the centre of the quadrant in the bore, and elevate or depreſs the piece 'till the plummet cuts the required elevation; and the piece is laid.

When the object fired at cannot be ſeen from the battery, which is often the caſe with mortars, proceed thus for the direction. Aſcend the neareſt ground in a line between the battery and object, from whence you can ſee them both, and place 2 pickets in ſuch a direction as to cut each mortar and the object it is to be fired at; then make the centres of metal of each mortar cut its proper picket, and it will be properly laid.

CARCASSES. See the firſt Alphabet.

COMPOSITION for each nature of CARCASSES.

Corned powder 30 lb. Swediſh pitch 12 lb. ſalt-petre 6 lb. and tallow 3 lb. The corned powder and ſalt-petre to be well mixed together; the pitch and tallow to be made hot over the fire, and put into another pan; then mixed with the corned powder and ſalt-petre; and laſtly, mix them well together for uſe. When old, they are to be primed with fuze compoſition.

Weight of new oblong hammered CARCASSES, *eſtabliſhed the 22d of April,* 1759.

Diam.	When empty		Coated		Filled		Woulded		Primed		Kitted	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
10-inch	33	0	33	10	64	14	69	8	70	4	71	2
8-inch	15	12	16	1	32	14	33	2	33	10	34	0
5½-in.	1	8	1	10	8	6			8	9	8	12
4⅖-in.	1	2	1	4	4	9			4	10	4	12

Dimenſions and weight of round CARCASSES, *as eſtabliſhed the 2d of Auguſt*, 1760.

	Diameter of the carcaſs		Diameter of the holes				Diſtance of each hole		Thickneſs of metal		
			The top hole		In the ſides						
Natures	Exterior	Interior	at top	at bottom	at top	at bottom	From the top hole	In the ſides one fr. anoth.	Of each of the holes	At the bot. of the carcaſs	Weight
	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	In. pts.	c. q. lb.
5 holes	12.75	8.20	3.40	3.$\frac{1}{4}$	2.40	2.$\frac{3}{10}$	6.20	7.0	2.0	2.55	1 2 14
4 holes	12.75	8.0	3.50	3.30	2.50	2.20	6.20	10.85	2.0	3.0	1 2 26
3 holes	12.75	7.50	4.0	3.80	2.80	2.60	6.20	12.0	2.0	3.25	1 3 4

* CAR, in *military antiquity*, a kind of ſmall carriage; figuratively, uſed by the poets for a chariot: it is mounted on wheels, repreſenting a ſtately throne, uſed in triumphs and on other ſolemn occaſions.

* CARIPI, in *military hiſtory*, a kind of cavalry in the Turkiſh army, which to the number of 1000 are not ſlaves, nor bred up in the ſeraglio, like the reſt, but are generally Moors, or renegado Chriſtians, arrived to the rank of horſe-guards to the Grand Signior.

CARTOUCHES, in *artillery*, are made of leather, to fling over the ſhoulder of the matroſs, who therein carries the ammunition from the magazine or waggon, for the ſervice of the artillery, when at exerciſe or on real ſervice.

* CASTRAMETATION, in the *art of war*, is the art of meaſuring or tracing out the form of a camp on the ground; yet it ſometimes has a more extenſive ſignification, by including all the views and deſigns of a general; the one requires only a mathematician, the other an experienced ſoldier. The ancients were accuſtomed to fortify their camps by throwing up intrenchments round them. The Turks, and other Aſiatic nations, fortify themſelves, when in an open country, with their waggons and other carriages. The practice of the Europeans is quite different; for the ſurety of their camp conſiſts in the facility and convenience of drawing out their troops at the head of their encampment; for which reaſon, whatever particular order of battle is regarded as the beſt diſpoſition for fighting, it follows of courſe, that we ſhould encamp in ſuch a manner as to aſſemble and parade our troops in that order and diſpoſition as ſoon as poſſible. It is therefore the order of battle that ſhould regulate the order of encampment; that is to ſay, the poſt of each regiment in the line of battle ſhould be at the head of its own encampment; from whence it follows, that the extent of the line of battle from right to left of the camp, ſhould be equal to the front of the troops in line of battle, with the ſame intervals in the camp as in the line. By this means every battalion covers its own tents, and they can all lodge themſelves, or turn out in caſe of neceſſity, at a minute's warning.

If the front of the camp is greater than the line, the troops muſt leave large intervals, or expoſe their flanks; if leſs, the troops will not have room to form with the proper intervals.

The front or principal line of the camp is commonly directed to face the enemy. See CAMP, in the firſt, and this Alphabet.

* CENTESTIMATION, in *ancient military hiſtory*, a mild kind of military puniſhment, in caſes of deſertion, mutiny, and the like, when only every 100th man is executed.

* CIRCLE, in *mathematics*, is a plane figure, comprehended under one line only, to which all right lines, drawn from a point in the middle of it, are equal to one another.

The angle BAC (Pl. XVI. *fig.* 1.) made by the tangent AB, and the chord AC, is equal to any angle AEC, or ADC, in the alternate ſegment AEC of the *circle*.

Let $ACDE$ be a quadrilateral figure in the *circle*, and the lines AD, EC, the diagonals, then $AC \times ED + AE \times CD = AD \times CE$.

In a *circle* the ſine of any arch is equal to half the chord of twice that arch. The ſquare of the chord of any arch is equal to the rectangle under the verſed ſine of that arch, and the diameter of the *circle*. The ſine of an arch is to the coſine thereof, as the radius is to the tangent of that arch. The radius is a mean proportional between the ſine of an arch and the coſecant of that arch. The radius is a mean proportional between the tangent of an arch and its cotangent. As the radius is to a mean proportional between the aggregate of the radius and ſine of the arch, and the difference between the radius and that ſine; ſo is twice that ſine to the ſine of double that arch.

In a ſemi-circle, if AB (*fig.* 4.) be the chord of an arch, and FD the chord of $\frac{1}{2}$ the complement of that arch to a ſemi-circle; then will the difference between the diameter AD and the chord AB, the chord FD, and the radius AC, be continual proportionals.

The method of finding the circumference of a *circle* from its diameter, or radius, being given, is one of the moſt uſeful problems in geometry. The ancient method of ſolving this noble propoſition, was to find continually the ſine of half the arch, which was performed in the following manner: the ſine LP being given, the coſine OP, and verſed ſine PN (*fig.* 5.) may be eaſily found; but $LNq = LPq + PNq$.

Wherefore $\sqrt{LPq + PNq} = LN = 2 LQ$. Therefore $\frac{1}{2} LN = QN = LQ$. Now as the ſine of 30° = half the radius, the ſine of 15° is had by the foregoing equation; and by repeating the operation, the ſine 7° 10′ may be found; and ſo on continually, 'till the ſine of the arch laſt found, its tangent, and conſequently, the arch itſelf is expreſſed by the ſame decimal part of the radius. But as this method was attended with frequent involutions, and extractions of roots of very large numbers, the greateſt mathematicians have endeavoured to find ſhorter and eaſier methods of obtaining the *circle*'s periphery. The moſt direct and eaſy method is by the help of the infinite ſeries.

Let C be the centre of a *circle* (*fig.* 3.) $CB = CA = 1$, the radius, $AB = x$ any arch, therefore, $AD = y$, its right ſine then will be CD, its coſine $= \sqrt{1 - yy}$.

Let CE be another radius of the *circle* infinitely near to CA, then will $EG = \dot{y}$ be the fluxion of the ſine AD, and the infinitely ſmall arch $EA = \dot{x}$, the fluxion of the arch AB. And from the ſimilarity of the triangles CAD and EAG, it will be as $CD : CA :: EG : EA$; that is, in ſpecies $\sqrt{1 - yy} : 1 :: \dot{y} : \dot{x}$. This expanded into a ſeries, and multiplied by $\dot{y}$, its fluent will be $y + \frac{y^3}{6} + \frac{3y^5}{40} + \frac{5y^7}{112} + \frac{35y^9}{1152} + \frac{63y^{11}}{2816}$, &c. the length of the arch AB. Hence the length of any ſine or ordinate in the *circle* being given, the correſponding arch may be eaſily found. If therefore the diameter of the circle be equal to 1. the circumference will be 3. 1415, 9265, 354 +.

The impoſſibility of expreſſing the exact proportion of the diameter of a *circle* to its circumference, by any received way of notation; and the abſolute neceſſity of having it as near a quadrature as poſſible, has put ſome of the moſt celebrated men in all ages upon endeavouring to approximate as near as may be to the truth. The firſt who attempted it with ſucceſs, was the elaborate Van Ceulen, a Dutchman, who by the ancient method, though ſo very laborious, carried it to 36 decimal places. The indefatigable Mr. Sharp carried it to 72 decimal places; and ſince that Mr. Machin has carried it to 100 places; and it is as follows. If the diameter of the *circle* be 1, the circumference will be 3. 14159, 26535, 89793, 23846, 26433, 83279, 50288, 41971, 69399, 37510, 58209, 74944, 59230, 78164, 05286, 20899, 86280, 34825, 34211, 70679, +, of the ſame parts; which is a degree of exactneſs far ſurpaſſing all imagination.

But the ratio's generally uſed in practice are as 7 to 22; as 106 to 333; 113 to 355; as 1702 to 5347; as 1815 to 5702; or as 1 to 3. 14159.

Since, when the diameter of a *circle* is 1, the circumference will be 3. 14159, 26536— of the ſame parts; and ſince all *circles* are ſimilar figures, it will be,

1. As 1, to 3. 14159, 26536—, ſo is the diamether of a *circle* to its circumference. Wherefore, if the diameter of any *circle* be multiplied by 3. 14159, 26536—, the product will be the length of the circumference in the ſame parts.

2. As 3. 14159, 26536— to 1, or as 1 to .31830, 98862—, ſo is the circumference of a *circle* to its diameter. Wherefore, if the circumferenee of any *circle* be divided by 3.14159, 26536—, or multiplied by its reciprocal .31830, 98862—, the former quotient, or the latter product, will give the diameter.

3. In the *circle* $BEGH$ (*fig.* 2.) put $BG = d$, or $OG = r$, then will $d = 2r$. Let A ſtand for the area, and c for the circumference, and ſuppoſe the arch $FG = x$ to be infinitely ſmall,

then will $\frac{rx}{2}$ be the area of the infinitely ſmall ſector OFG; this, therefore, multiplied by the whole circumference c, that is, putting c in the room of $\dot{x}$, we ſhall have $\frac{rc}{2} = A$, equal to the centre area of the *circle.*

4. Hence the area of any *circle* is found, by multiplying half the circumference by half the diameter or radius.

5. Hence every *circle* is equal to a triangle, whoſe baſe is equal to the circumference and perpendicular height of the radius.

6. Hence *circles* are to each other, as the ſquares of their reſpective diameters.

7. Hence, as 4 times the diameter to the circumference, ſo is the ſquare of the diameter to the area.

8. Hence *circles* are to each other, as the ſquares of their radii.

9. Hence, as the diameter of a *circle* is to its circumference, ſo is the ſquare of the radius to the area. Wherefore,

As 1, to 3.14159, 26536—, ſo is the ſquare of the radius, to the area of the ſame *circle.*

10. Hence *circles* are to each other as the ſquares of their peripheries or circumferences.

11. Hence, as 4 times the circumference is to the diameter, ſo is the ſquare of the circumference to the area. That is,

As 12.56637, 06144—, to 1, or as 1 to .07957, 74715; ſo is the ſquare of the periphery of any *circle,* to its area. Wherefore, if the ſquare of the periphery be divided by 12.56637, 06144—, or multiplied by .07957, 74715, the former quotient, or the latter product, will give its content.

CIRCLES. See GEOGRAPHY and GEOMETRY, in the firſt Alphabet.

COLOURS, *uſed in the drawings of fortification.* It is neceſſary to uſe *colours* in the drawings of plans and profiles of a fortification, in order to diſtinguiſh every particular part, and ſeparate, as it were, the one from the other, ſo as to make their difference more ſenſible. The different ſorts of *colours,* generally uſed in theſe kinds of drawings, are, *Indian-ink, carmine, verdigreaſe, ſap-green, gum-bouch, Pruſſian blue, indigo,* and *umber.*

Indian-ink, is the firſt and moſt neceſſary thing required in drawing; for it ſerves, in drawing the lines, to expreſs hills or riſing grounds, and, in ſhort, for all what is called ſhading in drawings. The beſt ſort of *Indian-ink* is of a bluiſh black, ſoft, and eaſily reduced into a liquid, free from ſand or gravel. It is ſold in ſticks from ſix-pence a ſtick to half a crown, according to its goodneſs and quantity. That made in Europe is good for nothing.

The manner of liquefying it, is by putting a little clear water into a ſhell or tea-cup, and rubbing it gently 'till the water is black, and of a conſiſtence much like common ink: when it is uſed for drawing lines, it muſt be made very black, though not too thick, otherwiſe it will not eaſily flow out of the drawing-pen; but when it is for ſhading, it muſt be pale, ſo as to go over the ſame ſhade ſeveral times, which adds a beauty to the ſhading.

Carmine, is an impalpable powder, and the faireſt red we know of: it ſerves for colouring the ſections of maſonry, the plans of houſes, and all kinds of military buildings; as likewiſe their elevation: but then it is made of a paler colour. It is alſo uſed for drawing red lines in plans, to repreſent walls. It is exceedingly dear, being generally ſold for a guinea an ounce; but a little will go a great way. It muſt be mixed with a little gum-water.

Verdegreaſe, or *ſea-green,* uſed in drawings, is either liquid in ſmall vials for ſix-pence a piece, or mixed in little pots or ſhells, &c. it ſerves to colour wet ditches, rivers, ſeas, and in general to repreſent all watery places.

Sap-green, is a ſtone of a feint yellowiſh green, when liquefied with clear water; but when mixed with a little ſea-green, it makes a beautiful graſs-green; but, as all mixed *colours* are liable to fade, if *verd'iris* can be had, it will be much better. *Sap-green* is very cheap.

Gum-bouch, is a fine yellow in ſtones, and very cheap. It may be diſſolved in water, but without gum: it ſerves to colour all projects of works; as likewiſe to diſtinguiſh the works unfiniſhed from thoſe that are ſo. It ſerves alſo to colour the trenches of an attack.

Indigo, is in ſmall cakes, and very cheap; it ſerves to colour iron, and roofs of buildings which are covered with ſlates: it muſt be well ground upon a ſmooth ſtone or glaſs, and mixed with a little gum-water.

Pruſſian blue, is a kind of friable ſtone, of an exceeding fine blue: it is uſed to repreſent the colour of blue cloth in drawing encampments, battles, &c. It muſt be well ground, and mixed with a little gum-water.

Smalt, alſo a good ſort of blue, and may be uſed for the ſame purpoſes. It is not dear.

Ultramarine, is an impalpable powder, and of a very delicate ſky-blue. It is a dear *colour.*

Umber, is a yellowiſh brown *colour* in powder: when it is mixed with gum-water, it ſerves to colour dry ditches, ſand, and all kinds of earth. By mixing a little red ink with it, it will make a wood *colour*.

If ſome tobacco-leaves are ſteeped in clear water for ſeveral hours, and filtered through a woollen cloth, or brown paper, with a little red ink mixed with it, it will make the beſt earth or wood *colour*, as lying ſmoother than any other.

Gum-water, is beſt when it is made ſome time before it is uſed; for which reaſon take ſome *gum arabic* and ſteep it in clear water for ſome hours, 'till it is diſſolved; then ſtrain it through a woollen cloth or brown paper, and preſerve it in phials, well ſtopped, 'till wanted.

COMMAND, in *military matters*. All *commands* fall to the eldeſt in the ſame circumſtance, whether of horſe, dragoons, artillery, foot, or marines. Among the officers of the corps of the Britiſh troops, entire or in parts, in caſe two of the ſame date interfere, a retroſpection of former commiſſions, or length of ſervice, is to be examined and ended by the judgment of the rules of war. See COMMAND, in the firſt Alphabet.

COUNTER *trenches*. See SIEGE.

COUNTER *working*, is the raiſing of works to oppoſe thoſe of the enemy. See COUNTER, &c. in the firſt Alphabet.

CROSS-*bar ſhot*, in *gunnery*, ſhot with iron bars croſſing through them, ſometimes ſtanding 6 or 8 inches out at both ſides: they are uſed at ſea, for deſtroying the enemy's rigging. At a ſiege they are of great ſervice in deſtroying the enemy's paliſading, &c. See SHOT, in the firſt Alphabet.

* CROWNS, in *ancient military hiſtory*, were of various uſes and denominations, viz.

Oval CROWN, *corona ovalis*, given to a general who, without effuſion of blood, had conquered the enemy.

Naval CROWN, *corona navalis*, diſtributed to thoſe who firſt ſhould board an enemy's ſhip.

Camp CROWN, *corona caſtrenſis*, the reward of thoſe who firſt paſſed the paliſades of, and forced an enemy's camp.

Mural CROWN, *corona muralis*, the recompence and mark of honour due to thoſe who firſt mounted the breach at an aſſault of a beſieged town.

Civil CROWN, *corona civica*, more eſteemed than the preceding: it was the diſtinguiſhing mark of thoſe who had ſaved the life of a Roman citizen in battle. It was given to Cicero for diſſipating the conſpiracy of Catiline, and denied to Cæſar, becauſe he imbrued his hands in the blood of his fellow citizens.

Triumphal CROWN, *corona triumphalis*, the ſymbol of victory, and preſented to a general who gained any ſignal advantage to the republic.

Graſs CROWN, *corona graminea*, was delivered by the whole Roman people to any general who had relieved an army inveſted or beſieged by the enemy. The other *crowns* were diſtributed by the emperors and generals; this was given to Fabius by the Roman people, for obliging Hanibal to decamp from Rome.

Olive CROWN, *corona oliva*, the ſymbol of peace, and preſented to the negotiators of it.

CUTTING-*off*. See RETRENCHMENT, in the firſt Alphabet.

D

DECOY, in a *military ſenſe*, is a very diverting ſtratagem to carry off the enemy's horſes in a foraging party, or from the paſture; to execute which, you muſt be diſguiſed, and ſo mix on horſeback in the paſture, or amongſt the foragers on that ſide on which you propoſe to fly: you muſt then begin, by firing a few ſhots, which are to be anſwered by ſuch of your party as are appointed to drive up the rear, and are poſted at the oppoſite extremity of the paſture, or foraging ground; after which they are to gallop from their different ſtations towards the ſide fixed for the flight, ſhouting and firing all the way: the horſes being thus alarmed, and provoked by the example of others, will break looſe from the pickets, throw down their riders and the truſſes, and ſetting up a gallop, will naturally direct their courſe to the ſame ſide; inſomuch that, if the number of them was ever ſo great, you might lead them in that manner for ſeveral leagues together: when you are got into ſome road, bordered by a hedge, or ditch, you muſt ſtop as gently as poſſible, and without making any noiſe, where the horſes will ſuffer themſelves to be taken without any oppoſition. It is called in French *Haraux*; and

Count Saxe is the only author that mentions it.

DODECAGON, in *geometry*, is a regular figure containing 12 equal ſides and angles. If the radius of a circle in which the *dodecagon* is inſcribed be = 1, then the ſide of the *dodecagon* will be nearly .654; and as one is to the ſquare of the ſide of any given *dodecagon*, ſo is 2.51956 to the area of it nearly.

* DODECAHEDRON, is one of the platonic bodies, or five regular ſolids, and is contained under 12 equal and regular pentagons.

The ſolidity of a *dodecahedron* is found by multiplying the area of one of the pentagonal faces of it by 12; and this latter product by 1-3d of the diſtance of the face from the centre of the *dodecahedron*, which is the ſame as the centre of the circumſcribing ſphere.

The ſide of a *dodecahedron* inſcribed in a ſphere, is the greater part of the ſide of a cube inſcribed in that ſphere, cut into extreme and mean proportion.

If the diameter of the ſphere be 1.0000, the ſide of a *dodecahedron* inſcribed in it will be .35682 nearly.

All *dodecahedrons* are ſimilar, and are to one another as the cubes of the ſides; and their ſurfaces are alſo ſimilar, and therefore they are as the ſquares of their ſides; whence, as .509282 is to 10.51462, ſo is the ſquare of the ſide of any *dodecahedron* to the ſuperficies thereof; and as .3637 is to 2.78516, ſo is the cube of the ſide of any *dodecahedron* to the ſolidity of it.

DUTY, in a *military ſenſe*, is the exerciſe of thoſe functions that belong to a ſoldier.

Regulations for doing Duty. In all *duties*, whether with or without arms, the tour of *duty* begins with the eldeſt downwards. 1ſt. *Duties* of honour, as the king's guard, the queen's guard, the prince of Wales's guard, and the captain-general's, or field-marſhal's, commanding the army. 2. Detachments of the army and out-poſts. 3. General officers guards. 4. The ordinary guards, both in camp and garriſon. 5. The picquets. 6. General courts-martial. 7. All kinds of *duty* called fatigues without arms.

An officer who is upon *duty*, cannot be ordered for any other before that *duty* is finiſhed, except he be on the picquet, and then the tour of the picquet ſhall paſs him.

If any officer's tour of *duty* for the picquet, general court-martial, or *duty* of fatigue, happen when he is on *duty*, he ſhall not make good ſuch *duty* when he comes off.

Guards, or detachments, which have not marched off from the parade, are not to be reckoned as for a *duty* done; but, if they ſhould have marched from the parade, it ſtands for a *duty* done, though they ſhould be diſmiſſed immediately.

General courts-martial that have aſſembled, and the members ſworn in, ſhall be reckoned on *duty*, though they ſhould be diſmiſſed without trying any perſon.

E

* ENCYCLOPŒDIA, meant originally no more than a circle; but at preſent it comprehends the whole circle or compaſs of learning, which comprehends all liberal arts and ſciences.

* ENGAGEMENT, in a *military ſenſe*, implies a particular or general battle by land, or an action of hoſtility between detachments of infantry or cavalry. The combat uſually begins by a vigorous cannonade, accompanied with the whole efforts of the ſmall arms, and the attack of the horſe, ſword in hand.

The various exigencies of the combat call forth the ſkill and reſources of the general, to keep the line of battle as complete as poſſible, when it has been equally attacked; by ordering troops from the reſerve, to ſupply the place of others who have ſuffered greatly by the action. His vigilance is ever neceſſary to review the ſituation of the enemy from van to rear, every motion of whom he ſhould, if poſſible, anticipate and fruſtrate. He ſhould ſeize the favourable moments of occaſion, which are rapid in their progreſs, and never return. See Battle, in the firſt Alphabet.

EPAULETTES, as a *military ornament*, are worn by all officers of the royal regiment of artillery, infantry, and cavalry. Thoſe for the dragoon-guards, horſe and dragoons, to have a gold or ſilver embroidered or laced *epaulette*, with fringe on the left ſhoulder. Thoſe of the light dragoons to have one on each ſhoulder. The officers of grenadiers to wear an *epaulette* on each ſhoulder. Thoſe of the battalion to wear one on the right ſhoulder only. They are to be either of embroidery or lace, with gold or ſilver fringe. Thoſe of the royal regiment of artillery to be gold embroidery, with gold fringe on ſcarlet cloth, and worn on the right ſhoulder. The cloth of *epaulettes* for the private men to be of the colour of the facing, with a narrow yellow or white tape round it, and worſted fringe.

F

FACE *of a baſtion*, the two ſides reaching from the flanks to the ſalient angle. Theſe in a ſiege are commonly the firſt undermined, becauſe they extend moſt outwards, and are the leaſt flanked; conſequently the weakeſt.

FACE *prolonged*, } FACE *extended*, } is that part of the line of defence razant, which is terminated by the curtain and the angle of the ſhoulder; that is, it is ſtrictly taken the line of defence razant, diminiſhed by the face of the baſtions.

FERDWIT, in *ancient military hiſtory*, a term formerly uſed to denote a freedom from ſerving upon any military expedition; or, according to ſome, the being quit of manſlaughter committed in the army.

FIELD, or *field of battle*, denotes a place where a battle was fought.

FIELD-*fort*. See FORT.

FIELD-*works*. See WORKS.

Running-FIGHT, that in which the enemy is continually chaced.

FIRE, in the *art of war*, is the diſcharge of all ſorts of fire-arms againſt the enemy. The fire of the infantry is by a regular diſcharge of their firelocks, by platoons, diviſions, &c. that of the cavalry, with their fuzees and piſtols; and that of a place beſieged, from their artillery.

FIRE *of the curtain*, or *ſecond flank*, is from that part of the curtain comprehended between the face of the baſtion prolonged, and the angle of the flank; frequently called the line of defence fichant.

FIRE *razant*, is by firing the artillery and ſmall arms in a line parallel with the horizon, or parallel with thoſe parts of the works you are defending.

FORTIFICATION. See this word in the firſt Alphabet.

Approaches, are a kind of roads or paſſages ſunk in the ground by the beſiegers, whereby they approach the place under cover of the fire from the garriſon.

Caponier, is a paſſage made in a dry ditch from one work to another: when they are made from the curtain of the body of the place to the oppoſite ravelin, or from the front of a horn or crown-work, they have a parapet on each ſide, of 7 feet high, ſloping in a glacis on the outſide to the bottom of the ditch: the width within is from 15 to 18 feet, with a banquette on each ſide: there is a brick wall to ſupport the earth within, which only reaches within 1½ foot of the top, to prevent grazing ſhot from driving the ſplinters amongſt the defendants.

Caponiers with two parapets may properly be called double; as there are ſome made with one parapet only, in dry ditches of the ravelin, and in that of its redout, towards the ſalient angles, and open towards the body of the place.

Caponiers made from the body of the place to the out-works, are ſometimes arched over, with loop-holes to fire into the ditch. The ſingle ones in the ditch of the ravelin and redout are likewiſe made with arches open towards the place; for by making them in this manner, the guns which defend the ditch before them, can no other way be diſmounted than by mines.

* *Aſſault*, is a ſudden and violent attack, made uncovered, on the part of the rampart where the breach has been made.

* *Attack*, is the manner and diſpoſition made by an army or ſmaller body of men, to drive an enemy out of a fortified place, or out of any ſtrong ſituation, or to gain a poſt, &c.

Attacks of a ſiege. See SIEGE.

Falſe attacks. See SIEGE.

To attack in flank, at a ſiege, is to attack both ſides of the baſtion; but againſt troops, is to fire along their line.

Barbet. See BATTERY.

* *Body of the place*, in a *general ſenſe*, means

the buildings in a fortified town: yet the incloſure round them is frequently underſtood by it; for we ſay, to conſtruct the body of the place, which means no more than to fortify or incloſe the place with baſtions and curtains, &c.

Breaſt-work. See PARAPET.

* *Capital of a work,* is an imaginary line which divides that work into two equal parts.

* *Capital of a baſtion,* a line drawn from the angle of the polygon to the point of the baſtion, or from the point of the baſtion to the centre of the gorge. Theſe capitals are from 35 to 40 toiſes in length, from the point of the baſtion to the place where the two demi-gorges meet.

* *Centre,* the middle point of any work. From the *centre* of a place are drawn the firſt lines to lay down the form of a *fortification.*

* *Centre of the baſtion,* is that point where the two adjacent curtains produced interſect each other.

Citadel, is a kind of fort or ſmall fortification, of 4, 5, or 6 ſides; ſometimes joined to towns, and ſometimes to defend rivers or paſſes, &c. They are generally built on the moſt advantageous ground, when near a city, the better to command it, and commonly divided from it by an eſplanade, or open place, the better to hinder the approach of an enemy.

Command, is when a hill or riſing ground overlooks any of the works of a *fortification,* and is within reach of cannon ſhot; ſuch a hill is ſaid to command that work. See COMMAND, in the firſt Alphabet.

* *Complement of the curtain,* is that part of the interior ſide which forms the demi-gorge.

* *Complement of the line of defence,* is the remainder of that line, after the angle of the flank is taken off.

* *Crowned horn-work,* is a *horn-work* with a *crown-work* before it. See CROWN-WORK, in the firſt Alphabet.

* *Demi-gorge,* is half the gorge or entrance into the baſtion, not taken directly from angle to angle, where the baſtion joins to the curtain, but from the angle of the flank to the centre of the baſtion, or rather the angle the two curtains would make were they protracted to meet in the baſtion.

* *Deſcent into the ditch,* is by trenches or guts made by way of ſaps in the ground of the counterſcarp, under the covert-way, and covered with madriers, or clays well loaded with earth, to ſecure them againſt fire. In ditches that are full of water, the deſcent is made even to the ſuperficies of the water; and then the ditch is filled with faggots, faſt bound, and covered with earth. In dry ditches the *deſcent* is carried down to the bottom; after which traverſes are made, either as lodgements for the troops, or to cover the miner.

Draw-bridge. See BRIDGE, in the firſt Alphabet.

Enfilade. A work is ſaid to be enfiladed, when the artillery can fire into it, ſo that the ſhot can fly along the inſide of the parapet.

* *Envelope,* is a work of earth raiſed ſometimes in the ditch, ſometimes like a plain parapet, and ſometimes like a ſmall rampart with a parapet to it. They are generally made before weak places.

Epaule, or the ſhoulder of the baſtion, the angle made by the union of the face and flank.

* *Eſcarp,* is, properly ſpeaking, any thing high and ſteep, and is uſed in *fortification* to expreſs the outſide of the rampart of any work next to the ditch.

* *Face prolonged,* that part of the line of defence razant, which is terminated by the curtain, and the angle of the ſhoulder.

Gorge of a flat baſtion, is a right line, which terminates the diſtance between two flanks.

Gorge of a half-moon, the diſtance between the two flanks, taken on the right of the counterſcarp.

Gorge of a ravelin, is the diſtrnce between the two ſides or faces towards the place.

Gorges of all other out-works, are the entry into them from the place, the diſtance between their ſides.

Gallery, is a paſſage made under ground, leading to the mines: they are from 4½ to 5 feet high, and about 3½ or 4 feet broad; ſupported at top by wooden frames, with boards over them.

* *Head of a work,* its front next the enemy, and fartheſt from the place.

Inſult. A work is ſaid to be *inſulted,* when it is attacked ſuddenly and openly.

* *Interior ſide of a fortification,* an imaginary line drawn from the centre of one baſtion to that of the next, or rather the curtain produced 'till they meet.

* *Place,* is commonly uſed in *fortification* inſtead of a fortified town.

Regular place, one whoſe angles, ſides, baſtions, and other parts are equal, &c.

Irregular place, one whoſe ſides and angles are unequal, &c.

Salient angle, is that whoſe point turns from the centre of the place outwards.

* *Sconce,* a ſmall field fort, built for the defence of ſome paſs. See *Fort.*

Swallow's tail, a kind of out-work, only differing from a ſingle tenaille, in that its ſides are not parallel as thoſe of the tenaille, but narrower towards the town than towards the country.

* *Terre plein of the rampart*, the horizontal ſuperficies of the rampart, between the interior talus and the banquette. It is on the *terre plein* that the garriſon paſs and re-paſs; it is alſo the paſſage of the rounds.

* *Wicket*, a ſmall door in the gate of a fortified place, at which a man on foot may go in, and which may be opened though the gate is ordered to be kept ſhut.

Works. All the fortifications about a place are called the *works* of a place.

Out-works. All detached *works* in a *fortification* are ſo called.

Field FORTIFICATION, is the art of conſtructing all kinds of temporary works in the field, ſuch as redouts, field-forts, ſtar-forts, triangular and ſquare forts, heads of bridges, and ſundry ſorts of lines, &c. An army intrenched or fortified in the field produces, in many reſpects, the ſame effect as a fortreſs; for it covers a country, ſupplies the want of numbers, ſtops a ſuperior enemy, or at leaſt obliges him to engage at a diſadvantage.

The knowledge of a field-engineer being founded on the principles of *fortification*, it muſt be allowed, that the art of fortifying is as neceſſary to an army in the field, as in fortified places; and though the maxims are nearly the ſame in both, yet the manner of applying and executing them with judgement, is very different.

A project of *fortification* is commonly the reſult of a long meditation; but in the field it is quite otherwiſe: no regard is to be had to the ſolidity of the works; every thing muſt be determinnd on the ſpot; the works are to be traced out directly, and regulated by the time and number of workmen, depending on no other materials than what are at hand, or no other tools than the ſpade, ſhovel, pick-axe, and hatchet. It is therefore in the field, more than any where elſe, that an engineer ſhould be ready, and know how to ſeize all advantages at firſt ſight, to be fertile in expedients, inexhauſtible in inventions, and indefatigably active.

Names of all the works uſed in field FORTIFICATION.

Bridge-heads, in *field fortification*, are made of various figures and ſizes, ſometimes like a redan or ravelin, with or without flanks, ſometimes like a horn or crown-work, according to the ſituation of the ground, or to the importance of its defence. Their conſtruction depends on various circumſtances; for, ſhould the river be ſo narrow, that the work may be flanked from the other ſide, a ſingle redan is ſufficient; but when the river is ſo broad, that the ſalient angle cannot be well defended croſs the river, flanks muſt be added to the redan; but ſhould a river be 100 toiſes or more acroſs, half a ſquare may be made, whoſe diagonal is the river ſide; and where a river is from 3 to 500 toiſes broad, a horn or crown-work ſhould be made. All the different ſorts of *heads of bridges*, are to be eſteemed as good works againſt a ſudden onſet only, and their uſe almoſt momentary, as they ſometimes ſerve but for a few days only, and at moſt during a campaign.

Forts, in *field-fortification*, are of various ſorts, viz.

Field-forts, may be divided into two kinds; the one defending itſelf on all ſides, as being entirely ſurrounded; the other, bordering on a river, &c. remain open at the gorge. They have the advantage of redouts, in being flanked, and the diſadvantage in containing leſs within, in proportion to their extent.

Star-forts, are ſo called, becauſe they reſemble that figure. They are commonly made of 4 angles, ſometimes of 5, and very rarely of 6; but we find them now made of 7 and 8 angles: but, let their figure be what they will, their angles ſhould be equal; and, can they be formed of equilateral triangles, ſo much the better; for then the flanking angle being 120°, the fires croſs better and nearer; and as the 2 flanks are on the ſame line, the ſpace, not defended before the ſalient angle, is reduced to a parallelogram, whoſe ſmalleſt ſide is equal to the gorge.

Baſtioned forts, differ in nothing from that of places, except that the figure be leſs, and the attack ſuppoſed of another kind. It is reckoned ſufficient to flank them with half-baſtions.

Triangular forts. As theſe kinds of *forts* contain leſs in proportion than any other, they are conſequently to be uſed as ſeldom as poſſible.

Square forts, are in many reſpects preferable to the triangular ones. See FORT, in the firſt Alphabet.

Dams, are generally made of earth, but ſometimes of other materials, as occaſion may require: their uſe is to confine water.

Flèche, a work conſiſting in two faces, terminating in a ſalient angle of 90°. the faces are generally 75 or 80 feet long, the parapet 6 feet thick, and the ditch 7 feet broad.

Lines, in *field fortification*, are of ſeveral ſorts, viz. the front of a fortification, or any other field-work, with regard to the defence, is a collection of lines, contrived ſo as reciprocally to flank each other.

Lines of intrenchment, are made to cover an army, or a place indifferently fortified, and which ſometimes contains the principal magazine of an army; or to cover a conſiderable extent of ground, to prevent an enemy from entering into the country to raiſe contributions, &c.

Lines, let their form or ſhape be what they will, ſhould be every where equally ſtrong, and every where guarded alike.

Maxims. 1ſt. To incloſe with the work as much ground as poſſible, having regard to circumſtances. This attention chiefly concerns redouts and ſmall works.

2d. If there are ſeveral works near each other, their lines of defence ſhould be ſo directed, as to defend each other, without annoying themſelves by their own fire.

3d. Not to depend on the defence of ſmall arms, but where they can fire at right angles; as they generally fire without aim, and directly before them.

4th. Not to have recourſe to the 2d flank or fire of the curtain, but when there is an abſolute neceſſity.

5th. That the flanking angle be always a right one, or more obtuſe, but never to exceed 100°, if poſſible, as there is no fear here, as in a fortification, of the flank being too much expoſed. Beſides, it is not neceſſary to graze the faces, or even to fire obliquely on them; ſince there is no danger of being expoſed to the defence of a breach, or lodgement of the miners. The only thing to apprehend, is a ſudden attack.

6th. That the flanking parts be ſufficiently extended, ſo that the interior of their parapets at leaſt rake the whole breadth of the oppoſite ditch.

7th. Never to make an advanced ditch in dry ground, unleſs it can be enfiladed throughout, and under a proper angle to be defended by the work which it covers or ſurrounds.

8th. Not to allow more than from 60 to 80 toiſes for the lines of defence, when they proceed from two flanks ſeparated by two branches, forming a ſalient angle, or when not made to croſs, though produced.

9th. That the parts moſt extended, and conſequently the weakeſt in themſelves, be as much defended as poſſible, and have at leaſt the fire of two flanks, beſides their own direct fire.

Redans, are a ſort of indented works, conſiſting of lines or faces, that form ſalient and re-entering angles, flanking one another. Lines are often conſtructed with redans: their ſalient angles are generally from 50 to 70°.

Indented redans, are when the two faces are indented (ſee Pl. XV. *fig.* 2.) in that caſe the faces of each indented angle is 8½ feet only.

Tambour, a kind of work formed of palliſades, 10 feet long, and 6 inches thick, planted cloſe together, and driven 2 or 3 feet into the ground; ſo that when finiſhed it has the appearance of a ſquare redout cut in two. Loopholes are made 6 feet from the ground, and 3 feet aſunder, for the ſoldiers to fire through, who are placed on ſcaffolds 2 feet high. They have often been uſed by the French with great advantage.

Têtes-de-pont. See *Bridge-heads.*

Trous-de-loup, are holes dug in the ground, circular at top, about 4½ feet diameter, and 6 feet deep, pointed at bottom, like an inverted cone, or ſugar-loaf. A ſtake 6 feet long is fixed in their centre, driven 2 feet into the ground, and made ſharp at top. Two or three rows of them are dug chequer-wiſe, about 6 paces from the ditch of a field-work. They prevent the approach of horſe, &c.

* FLOOR, a meaſure formerly uſed by our engineers, and in ſome parts of England at preſent. Its dimenſions are as follow: a meaſuring rod of 9 feet, two of which are called a perch or pole; that number ſquared; that is, 18 feet each way at right angles, and 1 foot deep, i. e. 324 ſolid feet of earth is called a *floor*.

* FRONTLET, or *aim frontlet*, is a piece of plank 3 inches thick, 1 foot long, and 7 or 8 inches high, with a round cavity underneath, to fit the outſide of the gun, with a ſlit to ſee the object through it. It is placed on the vent-field, to direct the gunners in pointing.

G

GAUGES, in *gunnery,* are braſs rings, with handles, to find the diameter of all kinds of ſhot with expedition.

GORGE. See FORTIFICATION.

GRAVITY, in *mechanics,* the natural tendency which all bodies have towards a centre.

Abſolute GRAVITY, is the whole force with which a body tends downwards, or towards the centre of the earth, and is always equal to the quantity of matter the body contains, without any regard to its bulk, ſo that the *abſolute gravity* of a pound of wood is equal to that of a pound of iron.

Relative GRAVITY, } is the exceſs of *gravity*
Specific GRAVITY, } of one body above that of another of equal dimenſions, and is always proportionable to the quantity of matter under that dimenſion. Thus a cubic inch of lead is heavier than a cubic inch of wood; for the lead, being more denſe than the wood, contains a greater quantity of matter under the ſame bulk. See GUNNERY.

* *To give* GROUND, in a *military ſenſe,* is to retire, to abandon or loſe the poſt a body of men has been in.

GUNNERY, is that military art which teaches us to determine the courſe and to direct the motion of bodies ſhot from artillery, or other warlike engines. The great importance of this art, is the reaſon that we diſtinguiſh it from the doctrine of projectiles in general; for in truth it is no more than an application of thoſe laws which all bodies obſerve when caſt into the air, to ſuch as are put in motion by the exploſion of guns, or other engines of that ſort: and it differs not whether we talk of projectiles in general, or of ſuch only as belong to *gunnery*; for, from the moment the force is impreſſed, all diſtinction, with regard to the power which put the body firſt in motion, is loſt, and it can only be conſidered as a ſimple projectile.

Every body caſt into the air, moves under the influence of two diſtinct forces. By the one it is carried forward with an equal motion, and deſcribes equal ſpaces in equal times, in the direction in which it was projected; and by the other, which we call *gravity,* is drawn downwards in lines perpendicular to the ſurface of the earth, with a motion continually accelerated, or whoſe velocity is always increaſing. If either of theſe forces were deſtroyed, the body would move according to the direction of the other alone, ſo far as its motion was not hindered by the interpoſition of other bodies; but as both continue to act, the courſe of the projectile muſt be determined by a power compounded of thoſe two forces.

Definitions of GUNNERY.

1. The *impetus* at any point of the curve is the perpendicular height to which a projectile could aſcend, by the force it has at that point; or the perpendicular height from which a body muſt fall to acquire the velocity it has at that point.

2. The *diameter* to any point of the curve is a line drawn through that point perpendicularly to the horizon. Thus AX, ax, are *diameters* to the point A, a, Pl. XVI. *fig.* 10.

3. The points A, a, where the diameters cut the curve, are called *vertexes* to theſe diameters.

4. The *axis* is that diameter which cuts the curve in its higheſt or principal vertex, and is perpendicular to the tangent at that point or vertex. Thus ax is the *axis* of the curve AC, and is perpendicular to the tangent at.

5. The *ordinates* to any diameter are lines drawn parallel to the tangent at the point where that diameter cuts the curve, and intercepted between the diameter and curve. Thus Da is an *ordinate* to the diameter AX, and dC is an *ordinate* to the axis ax, which is always at right angles with it.

6. The *abſciſs* is that part of the diameter which is intercepted between the ordinate and the curve. Thus AD is an *abſciſs* of the diameter AX, and ad one of the diameter ax.

7. The *altitude* of the curve is the perpendicular height of the principal vertex above the horizon. Thus ad is the *altitude* of the curve AaC.

8. The *amplitude, random,* or *range,* is the diſtance between the point of projection and the object aimed at. Thus AC is the *amplitude,* &c. of the curve AaC.

9. The *elevation* of the piece, is the angle its axis (produced) makes with the horizon, and the axis itſelf is called the direction.

10. The *horizontal diſtance,* to which a mortar, elevated to a given angle, and loaded with a given quantity of powder, throws a ſhell of a given weight, is called the range of that mortar, with that charge and elevation.

11. The *inclination of a plane,* is the angle it makes with the horizon, either above or below.

12. The *directrix* is a line paſſing through *M*, perpendicular to *A M*.

Laws of motion in Gunnery.

1. Spaces equally run through with equal velocities, are to one another as the times in which they are run through, and converſely.

2. Spaces equally run through in the ſame or equal times, are to one another, as the velocities with which they are run through, and converſely.

3. Spaces run through are in the ſame proportion to one another, as their times multiplied into their velocities, and converſely.

4. A body urged by two diſtinct forces in two different directions, will in any given time be found at the point where two lines meet that are drawn parallel to theſe directions, and though the points to which the body could have moved in the ſame time, had theſe forces acted ſeparately.

5. The velocities of bodies, which by the action of gravity began to fall from reſt, are in the ſame proportion as the times from the beginning of their falling.

6. The ſpaces run through by the deſcent of a body which began to fall from reſt, are as the ſquares of the times, from the beginning of the fall.

7. The motion of a military projectile is in a curve.

Remarks on Gunnery. As ſome who are entruſted with the management of artillery, are but too frequently found ignorant of the mathematical elements on which it is built, we ſhall endeavour to ſupply that defect in ſome meaſure by exhibiting two tables of proportions, which flow from the before-mentioned properties, which thoſe who peruſe the preceding laws of motion will perceive to flow from the properties there demonſtrated; and thoſe who do not, will be kind enough to take for granted.

The young artilleriſt will, I hope, by the help of theſe few proportions, be rendered more capable of performing what is uſually required in *gunnery*, than he could by mere practice.

In order to hit any mark, find your diſtance from it; (the piece's impetus you are ſuppoſed to know) and then uſe this proportion.

Twice the impetus is to the amplitude, as radius is to the ſine of double the angle of elevation. This angle is found practically by a quadrant and plummet, but beſt by a ſpirit-level and quadrant fixed on a ruler: but when the object is ſo near, that you can take aim with your eye, you need only diſpart your piece.

The piece is ſuppoſed to be truly bored, its carriage-wheels of an equal height, the ground whereon theſe ſtand level, the trunnions equally high on the carriage, the gun placed exactly in the middle of the carriage, and at right angles with the axle-tree.

The gunner is alſo ſuppoſed to know the uſe of ſuch inſtruments as are neceſſary for his purpoſe in the field; to have made frequent and exact trials of the gun's impetus, with a certain charge of the ſame powder; to have nicely proportioned that charge to the weight of the ſhot, and the execution he intends with it, at a given diſtance; and to have made ſuch other obſervations as in the courſe of his practice he will find uſeful. Theſe things being ſuppoſed, the two following tables will at one view give all the neceſſary caſes for firing at objects on the plane of the horizon, with proportions for their ſolutions; as alſo thoſe for firing on aſcents and deſcents; and none I think can be propoſed, that depend not immediately on, or may not be eaſily ſolved from them, in common practice.

TABLE I. For Horizontal Projections. *Fig.* 8 and 9. Pl. XVI.

Caſes	Given	Required	Solutions.
1	AM, Am	tAH Hv	$2AM : Am :: R : S2 \angle tAH$. $R : \mathcal{T} \angle taH :: \frac{Am}{4} : Hv$.
2	AM, tAH	Am	$R : S2 \angle taH :: 2AM : Am$.
3	Am, tAH	AM	$S2 \angle tAH : R :: \frac{Am}{4} : AM$.
4	AM, Hv	Am	$\sqrt{AN \times NM} = \frac{AM}{4}$, or ½ log. AN + ½ log. NM + ½ log. NM = log. ¼ Am.
5	Am, Hv	tAH AM	$\frac{AM}{4} : Hv :: R : \mathcal{T} \angle taH$. $AN : \frac{Am}{4} :: \frac{Am}{4} : NM$, and $AN + NM = AM$.
6	Hv, tAH	Am	$\mathcal{T} \angle tAH : R :: Hv : \frac{Am}{4}$.
7	tAH, Am and any other angle. Any other amplitude.	Any other amplitude belonging to that angle. Any other angle belonging to that amplit.	$S2 \angle tAH$: $S2$ any other $\angle$ :: Am : amplitude required. Am : any other amplitude :: $S2 \angle taH$: $S2 \angle$ required.
8	tAH, Hv any other angle. Any other altitude.	Any other altitude. Any other angle.	$V. S2 \angle tAH$: $V. S2$ any other $\angle$ :: Hv altitude required. Hv : any other altitude :: $V. S2 \angle tAHV$. $S2 \angle$ required.

The ſame ſtated numerically.

Caſe 1. The impetus $AM = 4000$, and amplitude $AM = 4200$ given, the direction tAH, and altitude vH required.

8000 : 4200 :: $R. S. 2 \angle \left\{\begin{matrix}15^\circ & 50'\\ 74 & 10\end{matrix}\right\}$ the $\left\{\begin{matrix}\text{loweſt}\\ \text{higheſt}\end{matrix}\right\}$ direction.

Or to the log. of 4200 add radius, and from their ſum ſubtract the log. of 8000, the remainder will be the logarithmic ſine of $\left\{\begin{matrix}31^\circ & 40'\\ 148 & 20\end{matrix}\right\}$ half of which is $\left\{\begin{matrix}15^\circ & 50'\\ 74 & 10\end{matrix}\right\}$ for the $\left\{\begin{matrix}\text{loweſt}\\ \text{higheſt}\end{matrix}\right\}$ direction.

R : tangent $\angle$ 15° 50′ :: 1050 : 298 the altitude.

Or to the logarithmic tangent of 15° 50′ add the log. of 1050, and from their ſum ſubtract radius, the remainder will be the log. of 298, the altitude required.

Caſe 2. The impetus $AM = 3600$, and the direction $\mathcal{T}AH = 75^\circ$ given, to find the amplitude AM.

$R. S2 \angle 75^\circ$ :: 7200 : 3600 amplitude $A.M.$

Caſe 3. The amplitude $AM = 3000$, and direction $GAH = 45^\circ$ given, to find the impetus AM.

Sine $2 \angle 45^\circ : R$ :: 1500 : 1500 impetus AM.

Caſe 4. The impetus $AM = 2600$, and altitude $Hv = 1300$ given, to find the amplitude.

$AM - AN = NM = 1300$, and $\sqrt{AN \times NM} = 1300$, a fourth part of 5200 the amplitude.

Caſe 5. The amplitude $AM = 3140$, and altitude Hv $(AN) = 250$ given, to find the direction and impetus.

$785 : 250 :: R :$ tangent of $\left\{\begin{matrix} 17^\circ & 40' \\ 72 & 20 \end{matrix}\right\}$ the $\left\{\begin{matrix} \text{lower} \\ \text{higher} \end{matrix}\right\}$ direction. $250 : 785 :: 785 : 2465$, which, added to 250, give the impetus 2715.

Caſe 6. The altitude $Hv = 368$, and direction $tAH = 40^\circ\ 15'$ given, to find the amplitude.

Tang. $\angle\ 40^\circ\ 15' : R :: 368 : 435$, the 4th part of 1740 the amplitude.

Caſe 7. The direction $tAH = 28^\circ\ 12'$ with its amplitude $AM = 2550$, and any other direction $= 37^\circ\ 28'$ given, to find the amplitude for that direction.

Sine $\angle\ 56^\circ\ 24' : 2550 :: S \angle\ 74^\circ\ 56 : 2956$, the amplitude ſought.

Caſe 8. The altitude $Hv = 180$, with its direction $tAH = 24^\circ\ 5'$ and any other altitude $= 400$ given, to find the direction for that other altitude.

$180 : 400 ::$ verſed ſine $48^\circ\ 10'$: verſed ſine $74^\circ\ 56'$, half of which is $37^\circ\ 28'$, the direction ſought.

Table II. For Projectiles on Aſcents and Deſcents. *Fig.* 6 and 7. Pl. XVI.

Caſes	Given	Required	Solutions.
1	AM, Am Bm, AB	TAH, tAH	$Am : Bm :: R : T.\ \angle\ BAm$, $\frac{1}{2}$ of which added to 45° gives $\angle\ GAz$. $AM : AB :: Ac : AC = CG.\ T.\ \angle\ GAz : R :: Gz : Az$ and $Az - Af = fz = PG$. $CG : PG :: R : V.S.$ of SG, $\frac{1}{2}$ of which added to, or taken from, GAz, gives the higher or lower direction required.
2	TAH, tAH AF.	AM	Log. of $AM =$ log. of $AF + 2$ log. $S.\ \angle\ MAF$ — log. $S\ \angle\ sAF$ — log. $S\ \angle\ MAs$.
3	TAH, tAH AM	AF	Log. of $AF =$ log. of $AM +$ log. $S\ \angle\ sAF$ + log. $S\ \angle\ MAs$ — 2 log. $S\ \angle\ MAF$.
4	BAm tAH, AB, & any other angle tAH.	ab, the amplitude for that other angle.	Log. of $Af =$ log. of $AF +$ log. $S\ \angle\ pAf$ + log. $S < pAM$ — log. $S\ \angle\ sAF$ — log. $S\ \angle\ MAs$. *Fig.* 9.
5	AM, DAH	Ag.	$T\ \angle\ GAz$: ſec. $\angle\ gAz :: Gz : Ag$. *Fig.* 6 and 7.

The ſame ſtated numerically.

Caſe 1. The horizontal diſtance $Am = 7000$, impetus $AM = 4200$, and the perpendicular height $Bm = 744$ given. to find the directions TAH, tAH.

$7000 : 744 :: R :$ tangent $6^\circ\ 4'$, half of which added to 45° gives the angle $GAz = 48^\circ\ 2'$.

$7000 : 7040 :: 2100 : 2112$. Tangent $48^\circ\ 2' : R :: 2100 : 1887{,}5$. $2112 :: 137{,}5 :: R$: verſed ſine of $20^\circ\ 48'$, half of which added to, or ſubtracted from, $48^\circ\ 2$, gives $\left\{\begin{matrix} 58^\circ & 26' \\ 37 & 38 \end{matrix}\right\} = \left\{\begin{matrix} TAH \\ tAH \end{matrix}\right\}$ the $\left\{\begin{matrix} \text{higher} \\ \text{lower} \end{matrix}\right\}$ direction.

Caſe 2. The angles of direction $\left\{\begin{matrix} TAH = \\ tAH = \end{matrix}\right\}$

$\left.\begin{matrix}58^\circ & 26'\\ 37 & 38\end{matrix}\right\}$ and the amplitude $AB = 7040$ given, to find the impetus AM.

To the log. of $AF = 1760$ add twice the logarithmic ſine of the angle $MAF = 83^\circ\ 56'$, and from their ſum ſubtract the logarithmic ſines of the angles $sAF = 31^\circ\ 34'$, and $MAs = 52^\circ\ 22'$, the remainder will give the log. of $2004 = AM$, the impetus required.

Caſe 3. The angles of the direction $\left\{\begin{matrix}TAH\\ tAH,\end{matrix}\right\} = \left\{\begin{matrix}58^\circ & 26'\\ 37 & 38\end{matrix}\right\}$ and impetus $AM = 4200$ given, to find the length of the inclined plane AB, or the horizontal diſtance Am, and perpendicular height Bm.

To the log. of $AM = 4200$, add the logarithmic ſines of the angles $sAF + 31^\circ\ 34'$, and $MAs = 52^\circ\ 22'$, and from their ſum ſubtract twice the logarithmic ſine of the angle $MAF = 83^\circ\ 56'$, the remainder will give the log. of $1760 = AF$, a fourth part of $7040 = AB$, the inclined plane.

Caſe 4. The angle of obliquity $BAm = 6^\circ\ 4'$, any angle of direction $tAH = 37^\circ\ 38'$ and its amplitude $AB = 7040$, and any other angle of direction $tAH = 31^\circ\ 4'$ given, to find the amplitude Ab for that other angle.

To the log. of $AF = 1760$ add the logarithmic ſines of the angles $pAf = 25^\circ$, and $pAM = 58^\circ\ 56'$, and from their ſum ſubtract the logarithmic ſines of the angles $sAF = 31^\circ\ 34'$, and $MAs = 52^\circ\ 22'$, the remainder will give the log. of $1537 = Af$ $\frac{1}{4}$ part of $6148 = Ab$ the amplitude. The converſe of this caſe is evident.

Caſe 5. The impetus $AM = 4200$, and angle of obliquity $DAH = 6^\circ\ 4'$ given, to find the greateſt random on the plane AB.

Tangent $\angle\ 48^\circ\ 2'$: ſec. $\angle\ 6^\circ\ 4'$ :: 2100 : 1899, a fourth part of 7596 the greateſt range.

SCHOLIUM.

When the perpendicular height is given, and the horizontal diſtance is required, the readieſt and, we think, the beſt way of finding it, is to obſerve, with an inſtrument, the angle which the object aimed at makes with the horizon, and to uſe this proportion.

As the tangent of that angle is to the perpendicular height given,

So is the radius to the horizontal diſtance required.

But when the horizontal diſtance is given, and the perpendicular height is required, ſay,

As radius is to the horizontal diſtance given,

So is the tangent of the angle found by obſervation, to the perpendicular height of the object required.

Example. Suppoſing in the firſt caſe Bm given $= 744$, and the angle BAm taken $6^\circ\ 4'$ ſay, tangent $\angle\ 6^\circ\ 4'$: 744 :: R : 7000, the horizontal diſtance.

And in the ſecond caſe, ſuppoſing Am given $= 7000$, and the angle BAm taken $= 6^\circ\ 4'$, then ſay,

R : 7000 :: tang. $= 6^\circ\ 4'$: 744, the perpendicular height.

Thus all the caſes of projections, as well on horizontal as on inclined planes, can be applied to numbers; and any mixed queſtions which contain caſes both on horizontal and inclined planes, may be deduced from them almoſt by inſpection. For inſtance:

1. Suppoſe a piece of artillery planted at A (*fig.* 6) its angle of direction $tAH = 37^\circ\ 38'$, the horizontal diſtance of the object $Am = 7000$, and its perpendicular height $Bm = 744$ given; to find that piece's amplitude on a horizontal plane, with the ſame impetus at any given direction; or its direction on a horizontal plane with any other given amplitude.

By *caſe* 2, of aſcents and deſcents, find its impetus $= 4200$; then by *caſe* 2, of horizontals, find its amplitude $= 7274$, with the other given direction of 30° for example; or by *caſe* 1, of horizontals, find its direction equal to 30°, with the other given amplitude 7274.

2. The random and direction of a piece on the plane of the horizon being given, to find its random on an inclined plane of a given obliquity, and with a given direction.

Firſt, find its impetus by *caſe* 2, of horizontals, and then its amplitude by *caſe* 3, of aſcents and deſcents.

3. Having the greateſt range of a piece on a plane of a given inclination, to find its greateſt amplitude on the horizon, ſay,

As the ſecant of the angle FAf is to the tangent of the angle GAz,

So is the fourth part of the greateſt range on the inclined plane, to a fourth part of the greateſt range on the horizon.

H

*HARBOURS, in *military architecture*, a port or haven for ſhipping. The making and incloſing *harbours* with piers, ſo as to reſiſt the winds and waves, for the preſervation of ſhips in ſtormy weather, is one of the moſt uſeful and neceſſary works that can be made in a trading nation; ſince the ſecurity of their wealth and power depends greatly upon it. Hence it ſhould be the particular ſtudy of every young engineer, who is deſirous of being uſeful to his country, or of diſtinguiſhing himſelf, to make himſelf maſter of this branch of buſineſs: to which end, let me recommend *L'Architecture Hydraulique*, par M. Belidor; *Eſſai ſur la Réſiſtance des Fluides*, par M. d'Alembert, Maclaurin and Muller.

* HARQUEBUS, in *military hiſtory*, a kind of fire-arms, of the length of a muſket, uſually cocked with a wheel. It carries a ſhot of about 3 ounces. Not uſed at preſent.

HONOURS *of war*, in a *ſiege*, is when a governor has made a long and vigorous defence; is at laſt obliged to ſurrender the place to the enemy, for want of men and proviſions; and makes it one of his principal articles, to march out with the *honours of war*; that is, with ſhouldered arms, drums beating, colours flying, and all their baggage, &c.

HOSTAGE, in the *art of war*, a perſon given up to an enemy, as a ſecurity for the performance of the articles of a treaty. When two enemies enter into a treaty or capitulation, it is common for them mutually to give hoſtages, as a ſecurity for their reciprocally performing the engagement they have entered into. An hoſtage becomes either an acceſſary, or principal, according to the ſtate of things. Thus, for example, he is acceſſary, when a prince promiſes fidelity to another prince, and gives either his ſon, or ſome great lord, as a ſecurity for his performance, without any further capitulation; for then theſe *hoſtages* are only an additional engagement of the prince; and if he violates his word, they are not in any manner reſponſible. An *hoſtage* becomes a principal, when it is ſtipulated that he ſhall be anſwerable for the event of things. For inſtance, if a city promiſe to ſurrender within a certain time, in caſe it is not ſuccoured, and, for the ſecurity of this article, give *hoſtages*; (which are in the ſame nature as bail given to a creditor to ſecure a debt:) ſo that, if the ſuccour arrives in time, the promiſe becomes void, and the *hoſtages* are diſcharged; but if the ſuccours do not arrive, and the city is guilty of a breach of faith, by refuſing to ſurrender, then the *hoſtages* become principal, and may be puniſhed for a breach of faith.

HOWITZER. See this word in the firſt Alphabet.

Dimenſions of braſs HOWITZERS, *as eſtabliſhed by the Board of Ordnance in* 1764.

Braſs howitzers	Nature	Length		Weight			Calibre of the howitz.	Diam. of the ſhell	Cham. con. pdr	
	Inche	F.	In.	C.	q.	lb.	In. hun.	In. hun.	lb.	oz
	8	3	1	11	0	0	8.0	7.75	3	8
	5.8	2	2	4	0	14	5.62	5.50	1	0
	4.5	1	10	2	0	14	4.52	4.40	0	8

N. B. The length is taken from the face of the muzzle to the back of the baſe ring, excluſive of the length of the caſcable.

HOWITZ-*battery*, is made the ſame as a gun-battery, only the embraſures are made at leaſt a foot wider, on account of the ſhortneſs of the *howitz*. See BATTERY.

K

*KIT, in *laboratory works*, a compoſition made of roſin 9lb. pitch 6lb. bees-wax 6lb. and tallow 1lb. uſed for the laſt covering of carcaſſes. When uſed, it muſt be broke into ſmall pieces, and put into an iron pot, over the fire, and kept ſtirring about until it is all diſſolved, and made very hot, which it muſt be whenever uſed; for it is then much better, and lies more equal, and cloſer on the carcaſs, than when it grows cold.

KITCHEN, in the *art of encamping*, is a ſpace of about 16 or 18 feet diameter; with a ditch ſurrounding it, 3 feet wide, the oppoſite bank of which ſerves as a ſeat for the men who dreſs the victuals. The *kitchens* of the flank companies are contiguous to the out-line of the camp, and the intermediate ſpace is generally diſtributed equally for the remaining *kitchens*; and as each tent forms a meſs, each *kitchen* muſt have as many fire-places as there are tents in the company.

L

LABORATORY. See that word in the firſt Alphabet.

Cartridges, are generally made of flannel, and filled with the following quantities of corned powder, both for land and ſea ſervice, viz.

Heavy	42-pound.	14lb.
	32 ———	10½
	24 ———	8
	18 ———	6½
	12 ———	5
	6 ———	3
	3 ———	1½
Medium	18-pdrs.	6½ lb.
	12 ———	4½
	6 ———	2½
	3 ———	1½
Light	24 ———	5
	12 ———	3
	6 ———	1½
	3 ———	12 oz.

Theſe *cartridges* are frequently fixed to round-ſhot, to caſe-ſhot, and to grape-ſhot, for the greater expedition in firing. See *Cartridges*, at the word LABORATORY, in the firſt Alphabet.

Flambeaux, a kind of lighted torch, uſed in the artillery upon a march, or the park, &c.

Formers, are cylinders of wood, of different ſizes and dimenſions, uſed in the *laboratory*, to drive the compoſition of fuzes and rockets.

Funnels, are of various ſorts, uſed to pour the powder into ſhells, and the compoſition into fuzes, and rocket-caſes.

Fuzes. See *Fuzes*, at the word LABORATORY, in the firſt Alphabet.

TABLE *of the different dimenſions of* Fuzes, *and time of burning, &c.*

Natures	Length of fuze	Diameter under the cap	Diameter at the end	Diameter of the cap inſide	Diameter of the cap outſide	Length of compoſition	Time of burning	Diameter of compoſition	Depth of the cap
Inches	In. & 10.	In. & 10.	In. & 10.	In. & 10.	In. & 10.	In. & 10.	Seconds	In. & 10.	In. & 10.
13	10.5	2.1	1.6	1.5	2.2	9.6	35to3	0.6	1.1
10	8.9	1.7	1.3	1.3	1.9	8.1½	30to35	0.4	0.9
8	8.1	1.5	1.1	1.1½	1.7½	7.2	29 to 31	0.3½	0.8
5½	5.6	1.2½	0.9	0.9	1.3	4.6	18 to 21	0.3	0.6
4⅖	4.7	1.1	0.7½	0.8½	1.1	4.0	15 to 17	0.3	0.5½
Hand-fuze	3.2	0.9	0.6½	0.6½	0.9	2.7	12 to 14	0.2	0.4
Muſ. mort.	3.1	0.7½	0.4½	0.5	0.7½	2.4½	10 to 12	0.1½	0.3½

How to drive Fuzes *into the ſhells*. When *fuzes* are to be drove, the lower end is cut off in a ſlope at the mark; ſo that the compoſition may give fire to the powder in the ſhell; and are to be of ſuch a length, that the ſhell may burſt as ſoon as it comes to the ground. The *fuze* is firſt put into the ſhell by the hand, and then drove with a mallet as far as it will go; taking care, however, not to ſplit it. As *fuzes* burn equal lengths, in equal times, great care muſt be taken, that thoſe of each nature be drove with the ſame mixture of compoſition, equally hard, in the ſame kind of weather, and, if poſſible, by the ſame perſon.

TABLE *of ſhells' ranges, in yards, at 45° elevation, by which* Fuzes *may be cut to any range required*

Sec.	Yards.	Sec.	Yards.	Sec.	Yards.	Sec.	Yards.	Sec.	Yards.	Sec.	Yards.
5	134	9¼	459	13½	977	17¾	1689	22	2595	26¼	3694
5¼	148	9½	484	13¾	1017	18	1737	22¼	2654	26½	3765
5½	162	9¾	509	14	1050	18¼	1785	22½	1714	26¾	3856
5¾	177	10	536	14¼	1088	18½	1835	22¾	2775	27	3908
6	193	10¼	563	14½	1127	18¾	1885	23	2836	27¼	3980
6¼	209	10½	591	14¾	1166	19	1935	23¼	2896	27½	4054
6½	226	10¾	619	15	1206	19¼	1986	23½	2961	27¾	4128
6¾	244	11	649	15¼	1 46	19½	2 38	23¾	3024	28	4203
7	263	11¼	678	15½	1288	19	2091	24	3088	28¼	4278
7¼	282	11½	709	15¾	1329	20	2144	24¼	3153	28½	4354
7½	301	11¾	739	16	1372	20¼	2 98	24½	3218	8	4431
7¾	322	12	772	16¼	1416	20½	2252	24¾	3284	29	4509
8	343	12¼	804	16½	1459	20¾	2308	25	3350	29¼	4587
8¼	365	2½	834	16¾	1504	21	2364	25¼	3418	29½	4665
8½	387	12¾	871	17	1549	21¼	2420	25½	3486	29¾	4745
8¾	412	13	906	17¼	1595	21½	2478	25¾	3555	30	4825
9	434	13¼	941	17½	1642	21¾	2536	26	3624	30¼	4905

By this table, if you know the diſtance, you likewiſe know how many ſeconds the ſhell was in the air; and by knowing the time, you alſo know the diſtance; and may cut the *fuze* accordingly, by burning one or two, and making uſe of a ſtop-watch with a ſecond hand, or a pendulum that vibrates ſeconds. *Example.* Any number of ſeconds being given, required the range at an angle of 45° belonging to that time. *Rule.* Square the time of flight, and multiply that by $16\frac{1}{12}$, and the product divided by 3, the quotient gives the range in yards.

Example 1. How many yards in 12 ſeconds will the range be at 45 degrees elevation? viz.

$$\frac{12 \times 12 \times 16\frac{1}{12}}{3} = 772 \text{ yards; or } 12 \times 12 \times 193 = \frac{27792}{36} = 772 \text{ yards as before}$$

Example 2. The range of 45° being given, to know the ſeconds it was performed in, viz.

Rule. Multiply the range by 3, and divide the product by $16\frac{1}{12}$, the ſquare root of the quotient gives the number of ſeconds; or, to avoid fractions, multiply the range by 36 the 12ths contained in 3, and divide the product by 193, the 12ths contained in $16\frac{1}{12}$, the ſquare root of the quotient gives the ſeconds.

$$\sqrt{\frac{772 \times 3}{16\frac{1}{12}}} = \sqrt{\frac{2216}{16\frac{1}{12}}} = \sqrt{144} = 12 \text{ ſeconds;}$$

$$\text{or } 772 \times 3 \div 193 = \sqrt{2316 \div 193} = \sqrt{144} =$$

12 ſeconds, as before.

Hair-cloths, are uſed on the floor of powder magazines, and other places in the *laboratory*, where powder is uſed, to prevent accidents by fire, from men's ſhoes treading or rubbing any thing that may ſtrike fire.

Small ladles, are made of copper, with ſhort handles: they are uſed in filling the fuzes of ſhells, and caſes of ſky-rockets, &c.

Port-fires, are paper caſes of 17 inches long, and about ½ an inch in diameter; one of which will burn from 13 to 16 minutes. They are uſed in firing guns, mortars, and howitzers; or to light recreative fire-works. Their compoſition is ſalt-petre 6 lb. ſulphur 2 lb. and mealed powder 1 lb. mixed in the ſame manner as fuze compoſition. See *fuzes* and *port-fires*, at the word LABORATORY, in the firſt Alphabet.

Rockets, are of various ſorts, and for various purpoſes; but thoſe we ſhall here mention, are generally made uſe of for ſignals in the field.

Signal Rockets, } They are ſometimes made
Sky Rockets. } with reports, and ſometimes without. They are ſometimes made to be bounced; in this inſtance, their caſes muſt be made 1¼ or 2 diameters longer than the common proportion. *Signal-rockets* with reports are ſometimes fired in ſmall flights, or otherwiſe, to begin an attack, &c. Their compoſition is, ſalt-petre, 4 lb. ſulphur 1 lb. and charcoal 1 lb. 8 oz.

Setters, are round ſticks to drive fuzes, or any other compoſition made of paper.

Sheep-ſkins, are always uſed to cover the muzzles of mortars and howitzers, between firing, to prevent any wet or dampneſs from getting into them.

Shot, are of various denominations, and for ſundry uſes in the *art of war*.

Round-ſhot, are all kinds of *ſhot*, from a 42-pounder to an ½ pounder.

Caſe-ſhot, are ſmall *ſhot* put into cylindrical tin boxes, that juſt fit the bores of thoſe pieces of artillery they are intended to be fired out of. Their weight is from 6 oz. to 1½ oz. and from 17 to 107 in one box. See *Caſe ſhot*, at the word LABORATORY, in the firſt Alphabet.

Grape-ſhot, a certain number of ſmall *ſhot* of iron or lead, quilted together with canvais and ropes about a pin of iron or wood, fixed upon a bottom of the ſame matter, ſo as the whole together weigh nearly as much as the *ſhot* of that calibre.

Length and weight of line for quilting ſea-ſervice Grape-ſhot.

Pounders.	Line		Wt. for 100	
	Feet	Inch.	lb.	oz.
42	10	1¼	14	8
32	9	2¼	12	0
24	8	10	10	10
18	7	4½	5	12
12	6	4¾	4	14
9	6	0	3	10
6	5	1	2	10
4	4	7¼	1	3
3	4		0	12
½	2	3½	0	4

See *Grape-ſhot*, at the word LABORATORY, in the firſt Alphabet.

Squibs. Their compoſition is, mealed powder 3 lb. charcoal 8 oz. ſalt-petre 3 oz. and ſulphur 1 oz.

Tarpaulins, are made of ſtrong canvas, thoroughly tarred, and cut into different ſizes, according to their different uſes in the field; ſuch as to cover the powder-waggons, tumbrels, and field-pieces, from rain.

M

MAIL, or *coat of mail*, in *military antiquity*, a piece of defenſive armour for the body, generally made of ſmall iron rings, interwoven in the manner of a net.

MENSURATION, in *military mathematics*, is the art and ſcience which is concerned about the meaſure of extenſion, or the magnitude of figures; and it is, next to arithmetic, a ſubject of the greateſt uſe and importance, both in affairs that are abſolutely neceſſary in human life, and in every branch of the mathematics: a ſubject by which ſciences are eſtabliſhed, and commerce is conducted; by whoſe aid we manage our buſineſs, and inform ourſelves of the wonderful operations in nature; by which we meaſure the heavens and the earth, eſtimate the capacities of all veſſels and bulks of all bodies, gauge our liquors, build edifices, meaſure our lands and the works of artificers, buy and ſell an infinite variety of things neceſſary in life, and are ſupplied with the means of making the calculations which are neceſſary for the conſtruction of almoſt all machines.

It is evident that the cloſe connection of this ſubject with the affairs of men would very early evince its importance to them; and accordingly the greateſt among them have paid the utmoſt attention to it; and the chief and moſt eſſential diſcoveries in geometry in all ages, have been made in conſequence of their efforts in this ſubject. Socrates thought that the prime uſe of geometry was to meaſure the ground, and indeed this buſineſs gave name to the ſubject; and moſt of the ancients ſeem to have had no other end beſides *menſuration* in view in all their laboured geometrical diſquiſitions. Euclid's elements are almoſt entirely devoted to it; and although there be contained in them many properties of geometrical figures which may be applied to other purpoſes, and indeed of which the moderns have made the moſt material uſes in various diſquiſitions of exceedingly different kinds, I ſay, notwithſtanding this, yet Euclid himſelf ſeems to have adapted them entirely to this purpoſe: for, if it be conſidered that his elements contain a continued chain of reaſoning, and of truths, of which the former are ſucceſſively applied to the diſcovery of the latter, one propoſition depending on another, and the ſucceding propoſitions ſtill approximating towards ſome particular object near the end of each book; and when at the laſt we find that object to be the equality, proportion, or relation between the magnitudes of figures both plane and ſolid; it is ſcarcely poſſible to avoid allowing this to have been Euclid's grand object. And accordingly he determined the chief properties in the menſuration of rectilineal plane and ſolid figures; and ſquared all ſuch planes, and cubed all ſuch ſolids. The only curve figures which he attempted beſides are the circle and ſphere; and when he could not accurately determine their meaſures, he gave an excellent method of approximating to them, by ſhewing how in a circle to inſcribe a regular polygon which ſhould not touch another circle, concentric with the former, although their circumferences ſhould be ever ſo near together; and, in like manner, between any two concentric ſpheres to deſcribe a polyhedron which ſhould not any where touch the inner one: and approximations to their meaſures are all that have hitherto been given. But although he could not ſquare the circle, nor cube the ſphere, he determined the proportion of one circle to another, and of one ſphere to another, as well as the proportions of all rectilineal ſimilar figures to one another.

Archimedes took up *menſuration* where Euclid left it, and carried it a great length. He was the firſt who ſquared a curvilineal ſpace, unleſs Hypocrates muſt be excepted on account of his lunes. In his times the conic ſections were admitted in geometry, and he applied himſelf cloſely to the meaſuring of them as well as other figures. Accordingly he determined the relations of ſpheres, ſpheroids, and conoids, to cylinders and cones; and the relations of parabolas to rectilineal planes whoſe quadratures had long before been determined by Euclid. He hath left us alſo his attempts upon the circle: he proved that a circle is equal to a right-angled triangle, whoſe baſe is equal to the circumference, and its altitude equal to the radius; and conſequently that its area is found by drawing the radius into half the circumference; and ſo reduced the quadrature of the circle to the determination of the ratio of the diameter to the circumference; but which however hath not yet been done. Being diſappointed of the exact quadrature of the circle, for want of the rectification of its circumference, which all his methods would not effect, he proceeded to aſſign an uſeful approximation to it: this he effected by the numerical calculation of the perimeters of the inſcribed and circumſcribed polygons; from which calculations it appears, that the perimeter of the circumſcribed regular polygon of 192 ſides is to the diameter, in a leſs ratio than that of $3\frac{1}{7}$ ($3\frac{10}{70}$) to 1, and that the inſcribed polygon of 96 ſides is to the diameter in a greater ratio than that of $3\frac{10}{71}$ to 1; and conſequently much more that the circumference of the circle is to the diameter in a leſs ratio than that of $3\frac{1}{7}$ to 1, but greater than that of $3\frac{10}{71}$ to 1: the firſt ratio of $3\frac{1}{7}$ to 1, reduced to whole numbers, gives that of 22 to 7, for $3\frac{1}{7} : 1 :: 22 : 7$, which therefore will be nearly the ratio of the circumference to the diameter. From this ratio of the circumference to the diameter he computed the approximate area of the circle, and found it to be to the ſquare of the diameter as 11 is to 14. He likewiſe determined the relation between the circle and ellipſe, with that of their ſimilar parts. The hyperbola too in all probability he attempted; but it is not to be hoped that he met with any ſucceſs, ſince approximations to its area are all that can be given by all the methods that have ſince been invented.

Beſides theſe figures, he hath left us a treatiſe on the ſpiral deſcribed by a point moving uniformly along a right line, which at the ſame time moves with an uniform angular motion; and determined the proportion of its area to that of its circumſcribed circle, as alſo the proportion of their ſectors.

Throughout the whole works of this great man, which are chiefly on *menſuration*, he every where diſcovers the deepeſt deſign and the fineſt invention; and ſeems to have been (with Euclid) exceedingly careful of admitting into his demonſtrations nothing but principles perfectly geometrical and unexceptionable: and although his moſt general method of demonſtrating the relations of curved figures to ſtraight ones, be by inſcribing polygons in them, yet to determine thoſe relations, he does not increaſe the number and diminiſh the magnitude of the ſides of the polygon *in infinitum*; but from this plain fundamental principle, allowed in Euclid's elements, viz. that any quantity may be ſo often multiplied, or added to itſelf, as that the reſult ſhall exceed any propoſed finite quantity of the ſame kind, he proves that to deny his figures to have the propoſed relations, would involve an abſurdity.

He demonſtrated alſo many properties, particularly in the parabola, by means of certain numerical progreſſions, whoſe terms are ſimilar to the inſcribed figures; but without conſidering ſuch ſeries to be continued *in infinitum*, and then ſumming up the terms of ſuch infinite ſeries.

He had another very curious and ſingular contrivance for determining the meaſures of figures, in which he proceeds as it were mechanically by weighing them.

Several other eminent men among the ancients wrote on this ſubject, both before and after Euclid and Archimedes; but their attempts were uſually upon particular parts of it, and according to methods not eſſentially different from theirs. Among theſe are to be reckoned Thales, Anaxagoras, Pythagoras, Bryſon, Antiphon, Hypocrates of Chios, Plato, Apollonius, Philo, and Ptolomy; moſt of whom wrote of the quadrature of the circle, and thoſe after Archimedes, by his method, uſually extended the approximation to a greater degree of accuracy.

Many of the moderns have alſo proſecuted the ſame problem of the quadrature of the circle, after the ſame methods, to greater lengths: ſuch are Vieta, and Metius, whoſe proportion between the diameter and circumference is that of 113 to 355, which is within about $\frac{3}{10000000}$ of the true ratio; but above all, Ludolph van Ceulen, who with an amazing degree of induſtry and patience, by the ſame methods extended the ratio to 20 places of figures, making it that of 1 to 3.14159265358979323846 +.

The firſt material deviation from the principles uſed by the ancients in geometrical demonſtrations was made by Cavalerius: the ſides of their inſcribed and circumſcribed figures they always ſuppoſed of a finite and aſſignable number and length; he introduced the doctrine of indiviſibles, a method which was very general and extenſive, and which with great eaſe and expedition ſerved to meaſure and compare geometrical figures. Very little new matter however was added to geometry by this method, its facility being its chief advantage. But there was great danger in uſing it, and it ſoon led the way to infinitely ſmall elements, and infiniteſimals of endleſs orders; methods which were very uſeful in ſolving difficult problems, and in inveſtigating or demonſtrating theories that are general and extenſive; but ſometimes led their incautious followers into errors and miſtakes, which occaſioned diſputes and animoſities among them. There were now however many excellent things performed in this ſubject; not only many new things were effected concerning the old figures, but new curves were meaſured; and for many things which could not be exactly ſquared or cubed, general and infinite approximating ſeries were aſſigned, of which the laws of their continuation were manifeſt, and of ſome of which the terms were independent on each other. Mr. Wallis, Mr. Huygens, and Mr. James Gregory, performed wonders; Huygens in particular muſt be admired for his ſolid, accurate, and very maſterly works.

During the preceding ſtate of things, ſeveral men, whoſe vanity ſeemed to have overcome their regard for truth, aſſerted that they had diſcovered the quadrature of the circle, and publiſhed their attempts in the form of ſtrict geometrical demonſtrations, with ſuch aſſurance and ambiguity as ſtaggered and miſled many who could not ſo well judge for themſelves, and perceive the fallacy of their principles and arguments. Among thoſe were Longomontanus, and our countryman Hobbs, who obſtinately refuſed all conviction of his errors.

The uſe of infinites was however diſliked by ſeveral people, particularly by Sir Iſaac Newton, who among his numerous and great diſcoveries hath given us that of the method of fluxions; a diſcovery of the greateſt importance both in philoſophy and mathematics; it being a method ſo general and extenſive, as to include all inveſtigations concerning magnitude, diſtance, motion, velocity, time, &c. with wonderful eaſe and brevity; a method eſtabliſhed by its great author upon true and inconteſtible principles; principles perfectly conſiſtent with thoſe of the ancients, and which were free from the imperfections and abſurdities attending ſome that had lately been introduced by the moderns: he rejected no quantities as infinitely ſmall, nor ſuppoſed any parts of curves to coincide with right lines; but propoſed it in ſuch a form as admits of a ſtrict geometrical demonſtration. Upon the introduction of this method moſt ſciences aſſumed a different appearance, and the moſt abſtruſe problems became eaſy and familiar to every one; things which before ſeemed to be inſuperable, became eaſy examples or particular caſes of theories ſtill more general and extenſive; rectifications, quadratures, cubatures, tangencies, caſes *de maximis & minimis*, and many other ſubjects, became general problems, and delivered in the form of general theories which included all particular caſes: thus, in quadratures, an expreſſion would be inveſtigated which defined the areas of all poſſible curves whatever, both known and unknown, and which, by proper ſubſtitutions, brought out the area for any particular caſe, either in finite terms, or in infinite ſeries of which any term or any number of terms could be eaſily aſſigned; and the like in other things. And although no curve, whoſe quadrature was unſucceſsfully attempted by the ancients, became by this method perfectly quadrable, there were aſſigned many general methods of approximating to their areas, of which in all probability the ancients had not the leaſt idea or hope; and innumerable curves were ſquared which were utterly unknown to them.

The excellency of this method revived ſome hopes of ſquaring the circle, and its quadrature was attempted with eagerneſs. The quadrature of a ſpace was now reduced to the finding of the fluent of a given fluxion; but this problem however was found to be incapable of a general ſolution in finite terms: the fluxion of every fluent was always aſſignable, but the reverſe of this problem could be effected only in particular caſes; among the exceptions, to the great grief of the geometers, was included the caſe of the circle, with regard to all the forms of fluxions attending it. Another method of obtaining the area was tried: of the quantity expreſſing the fluxion of any area, in general, could be aſſigned the fluent in the form of an infinite ſeries, which ſeries therefore defined all areas in general, and which, on ſubſtituting for particular caſes, was often found to break off and terminate, and ſo afford an area in finite terms; but here again the caſe of the circle failed, its area ſtill coming out an infinite ſeries. All hopes of the quadrature of the circle being now at an end, the geometricians employed themſelves in diſcovering and ſelecting the beſt forms of infinite ſeries for determining its area, among which it is evident that thoſe were to be preferred which were ſimple, and which would converge quickly; but it generally happened that theſe two properties were divided, the ſame ſeries very rarely including them both: the mathematicians in moſt parts of Europe were now buſy, and many ſeries were aſſigned on all hands, ſome admired for their ſimplicity, and others for their rate of convergency; thoſe which converged the quickeſt, and were at the ſame time ſimpleſt, which therefore were moſt uſeful in computing the area of the circle in numbers, were thoſe in which, beſides the radius, the tangent of ſome certain arc of the circle, was the quantity by whoſe powers the ſeries converged; and from ſome of theſe ſeries's the area hath been computed to a great extent of figures: Mr. Edmund Hally gave a remarkable one from the tangent of 30 degrees, which was rendered famous by the very induſtrious Mr. Abraham Sharp, who by means of it extended the area of the circle to 72 places of figures, as may be ſeen in Sherwin's book of logarithms; but even this was afterwards outdone by Mr. John Machin, who, by means deſcribed in Profeſſor Hutton's *Menſuration*, compoſed a ſeries ſo ſimple, and which converged ſo quickly, that by it, in a very little time, he extended the quadrature of the circle to 100 places of figures; from which it appears, that if the diameter be 1, the circumference will be 3.1415926535, 8979323846, 2643383279, 5028841971, 6939937510, 5820974944, 5923078164, 0628620899, 8628034825, 3421170679 +, and conſequently the area will be 7853981633, 9744830961, 5660845819, 8757210492, 9234984377, 6455243736, 1480769541, 0157155224, 9657008706, 3355292669 +.

From hence it appears, that all or moſt of the material improvements or inventions in the principles or method of treating of geometry, have been made eſpecially for the improvement of this chief part of it, *menſuration*; which abundantly ſhows, what I at firſt undertook to declare, the dignity of this ſubject; a ſubject which, as Dr. Barrow ſays, after mentioning ſome other things, “ deſerves to be more curiouſly weighed, becauſe from hence a name is impoſed upon that mother and miſtreſs of the reſt of the mathematical ſciences, which is employed about magnitudes, and which is wont to be called *Geometry* (a word taken from ancient uſe, becauſe it was firſt applied only to meaſuring the earth, and fixing the limits of poſſeſſions) though the name ſeemed very ridiculous to Plato, who ſubſtitutes in its place that more extenſive name of *Metrics* or *Menſuration*; and others after him give it the title of *Pantometry*, becauſe it teaches the method of meaſuring all kinds of magnitudes.” See SURVEYING, LEVELLING, and GEOMETRY.

MINING, in *military affairs*, is the art of blowing up any part of a fortification, building, &c. by gun-powder. The art of *mining* requires a perfect knowledge both of fortification and geometry; that by theſe previous helps, the engineer may be qualified to inform himſelf in the nature of all manner of heights, depths, breadths, and thickneſſes; to judge perfectly of ſlopes and perpendiculars, whether they be ſuch as are parallel to the horizon, or ſuch as are viſual; together with the true levels of all kinds of earth. To which muſt be added, a conſummate ſkill in the quality of rocks, earths, maſonry, and ſands; the whole accompanied with a thorough knowledge of the ſtrength of all ſorts of gunpowder.

Names of every thing uſed in MINING.

Auget, a kind of ſmall trough, made of ſtrong inch boards, about 4 inches ſquare, in which the ſauciſſon is laid in ſtraw, to prevent the powder from contracting any dampneſs.

Chamber, the place where the powder is lodged, being firſt put in cubical boxes made for that purpoſe.

Excavation, } the pit or hole made by a mine
Entonnoir, } when ſprung.

Focus, the centre of the chambre where the powder is lodged.

Fougaſs, a kind of ſmall mine.

Fourneau. See *Chamber*.

Miners tools, are augers of ſeveral ſorts, levers of different ſorts, needles for working in rocks, rakes, ſpades, ſhovels, ſledge-hammers, maſons' hammers, pick-axes, picks, mattocks, chiſſels, plummets, rules, a miner's dial, &c.

Line of leaſt reſiſtance, is a line drawn from the centre of the ſpace containing the powder, perpendicular to the neareſt ſurface.

Gallery, the paſſage leading to the powder.

Sauciſſon, is a pipe or hoſe made of coarſe cloth, whoſe diameter is about an inch, and filled with gun-powder; then laid in the trough or auget, which extends from the chamber to the entrance of the gallery, that the miner who ſets fire to it, may have time to retire before it reaches to the chamber. See *Mine*, in the firſt Alphabet.

* MOINEAU, in *ancient irregular fortification*, a kind of flat baſtion, raiſed on the centre of the curtain in old fortifications, when the baſtions were at too great a diſtance from each other.

MORTARS. See this word in the firſt Alphabet.

Dimenſions of all kinds of braſs MORTARS, *as eſtabliſhed by the Board of Ordnance, in* 1764.

	Nature	Length		Weight			Calibre of the mortar	Diameter of the ſhell	Chamber contains powder	
	In.	F.	In.	C.	q.	lb.	In.hun.	In.hun.	lb.	oz
Braſs Mortars	13 *S.*	5	3	82	0	0	13.0	12.75	30	0
	10 *S.*	4	9	33	0	0	10.0	9.75	12	8
	13 *L*	3	8	25	0	0	13.0	12.75	10	0
	10 *L.*	2	9	11	0	0	10.0	9.75	3	12
	8 *L*	2	2	4	0	0	8.0	7.75	2	0
	5.8 *R.*	1	4	1	1	0	5.62	5.50	0	9
	4.5 *C.*	1	1½	0	3	0	4.52	4.40	0	5

N. B. The length is taken from the front or face of the muzzle, to the back of the baſe-ring, excluſive of the length of the caſcable. *S.* ſtands for *ſea-ſervice mortar*, *L.* for *land-ſervice mortar*, *R.* for *royal mortar*, and *C.* for *coehorn mortar*.

O

OFFICERS. See that word in the firſt Alphabet.

Marine OFFICERS, all thoſe who command in that body of troops employed in the ſea-ſervice, under the direction of the lords of the admiralty.

* ORB, in *tactics*, is the diſpoſing of a number of ſoldiers in circular form of defence. The *orb* has been thought of conſequence enough to employ the attention of the famous marſhal de Puyſegur, in his *art of war*, who prefers this poſition, to throw a body of infantry in an open country, to reſiſt cavalry, or even a ſuperior force of infantry; becauſe it is regular, and equally ſtrong, and gives an enemy no reaſon to expect better ſucceſs by attacking one place than another. Cæſar drew his whole army in this form, when he fought againſt Labienus. The whole army of the Gauls were formed into an *orb*, under the command of Sabinus and Cotta, when fighting againſt the Romans. The *orb* was generally formed 6 deep.

ORDERS, in a *military ſenſe*, are of two ſorts, viz.

General ORDERS, are ſuch as are given out every day by the general who commands, who gives them in writing to the adjutant-general, who firſt ſends exact copies to the general officers of the day, and diſtributes them at his own quarters to all the brigade majors, who daily go to head quarters for that purpoſe: there they write down every thing that is dictated to them; from thence they go and give the *orders*, at the place appointed for that purpoſe, to the different majors or adjutants of the regiments which compoſe that brigade, who firſt read them to their colonels and lieutenant-colonels, and then dictate them to a ſerjeant of each company (this is more frequently done by the ſerjeant-major) who write them correctly down in their reſpective orderly-books, and bring them to all the officers belonging to the company.

Regimental ORDERS, are ſuch as regard the regiment only, the ſame as the *general orders* regard the whole army. Theſe orders are given out by the commanding-officer of each regiment.

Orderly non-commiſſioned officers, are thoſe who are orderly, or on duty for that week; who, on hearing the drum beat for orders, are to repair to the place appointed to receive them, and to take down in writing, in the orderly-book, what is dictated by the adjutant or ſerjeant-major; they are then immediately to ſhow thoſe orders to the officers of the company, and afterwards warn the men for duty.

ORDER *of the Bear*, a military order in Switzerland, erected by the emperor Frederic II. in 1213, by way of acknowledgment for the ſervice the Swiſs had done him, and in favour of the Abbey of St. Gal. To the collar of the order hung a medal, on which was repreſented a *bear*, raiſed on an eminence of earth.

P

PARADE, in a *military ſenſe*, the place where troops aſſemble, before they go on duty.

General PARADE, in *garriſon*, is that place where the troops aſſemble, after marching from their officers quarters, and regimental *parade*.

Regimental PARADE, in *garriſon*, is that place where the troops of each company aſſemble for duty, before they march to the *general parade*.

PARADE, in *camp*, is that ſpot of ground in the front of each incampment, between the camp-colours on the right and left wings. See PARADE, in the firſt Alphabet.

* PARTUISAN. See SPANTON.

* PELATON. See PLATOON.

PIONEERS. See this word in the firſt Alphabet. Each *pioneer* to have an axe, a ſaw, and an apron; a cap with a leather crown, and a black bear-ſkin front, on which is to be the king's creſt in white, on a red ground; alſo an axe and a ſaw. The number of the regiment to be on the back part of the cap.

PLACE, in a *military ſenſe*, is a general name for all kinds of fortified towns, forts, or fortreſſes, where a party may defend themſelves.

A regular PLACE, is one whoſe angles, ſides, lines, baſtions, and other parts, are equal; generally called, from the number of its angles, a pentagon, hexagon, &c.

Irregular PLACE, is one whoſe ſides and angles are unequal. See PLACE, in the firſt Alphabet, &c.

PLASTER, in *building*, a ſubſtance made of water and ſome abſorbent matter, ſuch as chalk or lime, well pulveriſed, with which walls are overlaid. It differs from common lime, in that it compoſes a ſolid body by itſelf, without mixing either ſand or any other ingredient, as is done in lime. The beſt ſort is made of a bluiſh ſoft ſtone, taken out of quarries, much like the ſtone of which Dutch terraſs is made. This ſtone is burnt in the ſame manner as lime, and, when cold, beat into a fine powder; and when uſed, about a buſhel is put into a tub, and water poured in, 'till it becomes liquid; then well ſtirred, and uſed immediately.

* PLUGS, in *artillery*, are either wood or cork, to ſtop the fuze-holes of ſhells.

PONT. See BRIDGES, in the firſt Alphabet.

Têtes de PONT. See FIELD-FORTIFICATION.

PRIMING, in *gunnery*, the train of powder that is laid, from the opening of the vent, along the gutter or channel, on the upper part of the breech of the gun, which, when fired, conveys the flame to the vent, by which it is further communicated to the charge, in order to fire the piece. This operation is only uſed on ſhipboard, at the proof, and ſometimes in garriſon; for, on all other occaſions, tubes are uſed for that purpoſe.

* PRIMING-*wire*, in *gunnery*, a ſort of iron needle, employed to penetrate the vent or touch-hole of a piece of ordnance, when it is loaded, in order to diſcover whether the powder contained therein is thoroughly dry, and fit for immediate ſervice; as likewiſe to ſearch the vent and penetrate the cartridge, when the guns are not loaded with looſe powder.

PYROTECHNY, in the *art of war*, is the doctrine of artificial fire-works and fire-arms: teaching both the uſe and conſtruction of thoſe uſed in war; ſuch as gunpowder, cannon, mortars, howitzers, ſhells, ſhot, grape, grenades, carcaſſes, mines, ſmall-arms, and all kinds of military fire-works; with the art of founding guns, &c.

Q

QUARTER-*guard*. See GUARD, in the firſt Alphabet.

The *quarter-guard* is always commanded by a ſubaltern officer, and conſiſts of about 20 or 30 men, whoſe duty it is to maintain good order in the camp. This guard now fronts outwards, though it was formerly the cuſtom to front inwards, that is, to face the battalion; and as this guard is merely to maintain good order in the camp, the preſent alteration ſeems improper. The *quarter-guards* of all foreign troops front inwards. Thoſe who wiſh to be well acquainted with guards, and encampments, will find ſatisfaction in Lochée's uſeful *Eſſay on Caſtrametation*.

R

* RAVES, in *artillery carriages*, are the upper wooden bars in a cart or waggon, ſupported by the round and flat ſtaves which enter into them.

REAR-*guard*. See GUARD, in the firſt Alphabet.

REAR-*guard*, is always commanded by a non-commiſſioned officer, generally a corporal, and 6 or 8 men. This guard ſerves to keep good order in the rear of the camp, and has, 'till of late, fronted inwards; and the reaſon of its now fronting outwards is, in my humble opinion, improper.

REGIMENT *of artillery*. See ARTILLERY, in the firſt Alphabet.

* RHOMBUS, in *geometry*, an oblique-angled parallelogram, or a quadrilateral figure whoſe ſides are equal and parallel, but the an-

gles unequal; two of the oppoſite ones being obtuſe, and the other two acute.

* RHOMBOIDES, in *geometry*, a quadrilateral figure whoſe oppoſite ſides and angles are equal, but is neither equilateral nor equiangular.

ROSE-*buds*. See Nails, in the firſt Alphabet.

S

*SALLY-*ports*, in *fortification*, or *poſtern-gates*, as they are ſometimes called, are thoſe under-ground paſſages, which lead from the inner works to the outward ones; ſuch as from the higher flank to the lower, or to the tenailles, or the communication from the middle of the curtain to the ravelin. When they are made for men to go through only, they are made with ſteps at the entrance, and going out. They are about 6 feet wide, and 8½ feet high. There is alſo a gutter or ſhore made under the *ſally-ports*, which are in the middle of the curtains, for the water which runs down the ſtreets to paſs into the ditch; but this can only be done when there are wet ditches.

When *ſally-ports* ſerve to carry guns through them for the out-works, inſtead of making them with ſteps, they muſt have a gradual ſlope, and be 8 feet wide.

SASHES, in *military dreſs*, are badges of diſtinction, worn by the officers of moſt nations, either round their waiſt, or over their ſhoulders. Thoſe for the Engliſh army are made of crimſon ſilk; for the Imperial army, crimſon and gold; for the Pruſſian army, black ſilk and ſilver; the Hanoverians, yellow ſilk; the Portugueze, crimſon ſilk with blue taſſels.

SENTINELS. See this word in the firſt Alphabet.

All *ſentinels* are to be vigilant on their poſts; neither are they to ſing, ſmoke tobacco, nor ſuffer any noiſe to be made near them. They are to have a watchful eye over the things committed to their charge. They are not to ſuffer any light to remain, or any fire to be made near their poſts in the night-time; neither is any *ſentry* to be relieved, or removed from his poſt, but by the corporal of the guard. They are not to ſuffer any one to touch or handle their arms, or in the night-time to come within 10 yards of their poſt.

No perſon is to ſtrike or abuſe a *ſentry* on his poſt; but when he has committed a crime, he is to be relieved, and then puniſhed according to the rules and articles of war.

A *ſentinel*, on his poſt in the night, is to know nobody, but by the counterſign: when challenges, and is anſwered, *Relief*, he calls out, *Stand, relief! advance, corporal!* upon which the corporal halts his men, and advances alone within a yard of the *ſentry*'s firelock (firſt ordering his party to reſt, on which the *ſentry* does the ſame) and gives him the counterſign, taking care that no one hear it.

* SEWER, in *military architecture*, a drain, conduit, or conveyance, for carrying off water foilage, &c. It is neceſſary that every building have conveniences for diſcharging its refuſe water, and other uſeleſs and offenſive matters: theſe are obtained by digging and laying *ſewers* and drains at proper depths, and with the needful outlets: the great care is, that they be large enough; that they be placed deep enough, and have a proper deſcent; that they be well arched over, and have ſo free a paſſage, that there be no danger of their choaking up; the cleaning them being a work of trouble and expence.

Inſtead of making the bottom of the *ſewer* a flat floor, let it be in form of an inverted arch, anſwering in part to the ſweep of the arch above. Every one knows that the freeſt paſſage that can be, is through circular channels; and theſe would ſufficiently wear that form; they would in a manner reſemble ſo many vaſt water-pipes of a circular baſe, and there would be no danger of their filling up. The perpendicular walls would detain nothing, becauſe there are no angles in their joining; and the bottom being round and free, all would run off eaſily as it ſhould.

SHELLS. See this word in the firſt Alphabet.

To find the weight of a Shell. *Rule.* Double the difference of the diameters of the *ſhell* and hollow ſphere, and 7 times the reſult gives the weight in pounds, cutting off the two right-hand figures of whole numbers.

Example. Let the diameter of the ſhell be 13 inches, and that of the hollow ſphere 9.5. Then the cube of 13 is 2197, and that of 9.5 is 857.375; the difference is 1339.625, its double is 2679.25, which multiplied by 7, gives 18754.625; and cutting off two places in whole numbers, the reſult is 187 lb. or 1 cwt. 2 qrs. 21 lb. the weight of the ſhell.

SHOT. See this word in the firſt Alphabet.

To find the weight of an iron SHOT, whoſe diameter is given; and the contrary. *Rule.* Double the cube of the diameter in inches, and multiply it by 7; ſo will the product (rejecting the 2 laſt or right-hand figures) be the weight in pounds.

Example. What is the weight of an iron *ſhot* of 7 inches diameter? The cube of 7 is 343, which doubled is 686, and this multiplied by 7 produces 4802, which, with the right-hand figures rejected, gives 48 pounds, the weight required.——N. B. This rule is ſufficiently exact for practical uſes.

To find the diameter of the SHOT, when the weight is given. *Rule.* Multiply the cube root of the weight in pounds by 1.923, and the product is the diameter in inches.

Example. What is the diameter of an iron *ſhot* of 52 pounds? The cube root of 52 is 3.732, which multiplied by 1.923 gives 7.177 inches, the diameter required.

Rule by logarithms.

To $\frac{1}{3}$ of the log. of 52 - - - 0.572001
Add the conſtant log. - - - 0.283979

And the ſum is the log. of the diameter 7.177 - - - } 0.855980

To find the diameter of a SHOT, from the impreſſion or cavity it makes by ſtriking a braſs gun, or other object. *Rule.* Divide the ſquare of the radius of the cavity by the depth of it, and add the quotient to the depth; ſo will the ſum be the diameter of the *ſhot* required.

Example. A *ſhot* having ſtruck upon a braſs gun, made a cavity of 1.49 inches deep, and 4.94 inches diameter; what was the ſize of the *ſhot?* The radius of the cavity is 2.47, and its ſquare is 6.1009, which divided by the depth 1.49, the quotient is 4.1, to which adding 1.49, the ſum 5.59 inches is the diameter required, anſwering to a 24-pounder.

SIGNALS *by the drum*, made uſe of in exerciſe, inſtead of the word of command, viz.

SIGNALS by the drum.	*Operations.*
A ſhort roll, -	To caution.
A flam, - -	To perform any diſtinct thing.
To arms, -	To form the line or battalion
The march, -	To advance, except when intended for a ſalute.
The quick march, -	To advance quick.
The point of war, -	To march and charge.
The retreat, - -	To retreat.
Drum ceaſing, - -	To halt.
Two ſhort rolls, -	To perform the flank firing
The dragoon march,	To open the battalion.
The grenadier march,	To form the column.
The troop, - -	To double diviſions.
The long roll, - -	To form the ſquare.
The grenadier march,	To reduce the ſquare to the column.
The preparative, -	To make ready and fire.
The general, - -	To ceaſe firing.
Two long rolls,	To bring or lodge the colours.

SIGNS, in the *art of war*, certain *ſigns* by which the intention of the enemy may be diſcovered. The moſt infallible indication of the enemy's deſigns, previous to his taking the field, is the place where he depoſits his magazines.

When an army intends to march, it is a general cuſtom to cook their kettles on that day particularly. If therefore you perceive, at 5 or 6 o'clock in the morning, more ſmoke than ordinary in their camp, you are pretty certain they intend to move.

When an army intends to fight, it is a general cuſtom to call in all their large detachments of light troops; therefore, when you ſee this, you muſt be upon your guard.

If you have always the ſame general to contend with, you will in time be able, by repeated obſervations on his diſpoſition and manner of acting, to foreſee his deſigns.

* SLATE, in *military architecture*, a kind of bluiſh foſſile ſtone, very ſoft when dug out of the quarry, and therefore eaſily ſlit or ſawed into thin long ſquares, to ſerve inſtead of tiles for the covering of all kinds of military buildings, &c.

* SLUICES, in *military architecture*, are made for various purpoſes; ſuch as to make rivers navigable; to join one river to another, which is higher or lower, by means of a canal; to form inundations upon particular occaſions, or to drain ſpots of ground that are overflowed by high tides; they are alſo made in fortreſſes, to keep up the water in one part of the ditches, whilſt the other is dry; and to raiſe an inundation about the place when there is any apprehenſion of being attacked

SLUICES are made different ways, according to the uſes they are intended for: when they ſerve for navigation, they are ſhut with two gates preſenting an angle towards the ſtream;

when they are made near the ſea, two pair of gates are made, the one pair to keep the water out, and the other in, as occaſion may require: in this caſe, the gates towards the ſea preſent an angle that way, and the others the contrary way. The ſpace incloſed by theſe gates is called *chamber*.

When *ſluices* are made in the ditches of a fortreſs to keep up the water in ſome parts, inſtead of gates, ſhutters are made, ſo as to ſlide up and down in gutters, or grooves; and when they are made to raiſe an inundation, they are then ſhut by means of ſquare timbers let down into *culliſes*, ſo as to lie cloſe and firm. Particular care muſt be taken in the building of a *ſluice*, to lay the foundation in the ſecureſt manner; that is, to lay the timber, grates, and floors, in ſuch a form, that the weather cannot penetrate through any part, otherwiſe it will undermine the work, and blow it up, as it has ſometimes happened: laſtly, to make the gates of a proper ſtrength in order to ſupport the preſſure of the water, and yet to uſe no more timber than what is neceſſary. Thoſe who wiſh to be thoroughly acquainted with this kind of work, may meet with ſatisfaction in *L'Architecture Hydraulique, par M. Belidor*, or in Mr. Millar's *Practical Fortification.*

SURVEYING, in *military mathematics*, the art or act of meaſuring lands; that is, of taking the dimenſions of any tract of ground, laying down the ſame in a map or drawing, and finding the content or area thereof.

Surveying, called alſo *geodæſia*, is a very ancient act; it is even held to have been the firſt or primitive part of geometry, and that which gave occaſion to, and laid the foundation of all the reſt.

Surveying conſiſts of three parts: the firſt is, the taking of the neceſſary meaſures, and making the moſt neceſſary obſervations, on the ground itſelf; the ſecond is, the laying down of theſe meaſures and obſervations on paper; and the third, the finding the area or quantity of the ground there laid down. The firſt is what we properly call *ſurveying*; the ſecond we call *plotting, protracting*, or *mapping*; and the third, *caſting up*.

The firſt, again, conſiſts of two parts, viz. the making of obſervations for the angles, and the taking of meaſures for the diſtances. The former of theſe is performed by ſome one or other of the following inſtruments, viz. the theodolite, circumferentor, ſemi-circle, plain table, or compaſs. The latter is performed by means either of the chain, or perambulator.

The ſecond branch of *ſurveying* is performed by means of the protractor, and plotting ſcale. The third, by reducing the ſeveral diviſions, incloſures, &c. into triangles, ſquares, trapeziums, parallelograms, &c. but eſpecially triangles; and finding the areas or contents of theſe ſeveral figures. See Love's *Geodæſia*, and Wyld's *Practical Surveyor*.

T

TABLE *of all the different dimenſions for iron* TAMPIONS *uſed in ſea-ſervice grape ſhot.*

Natures	Bottom		Spindle	
Pounders	Diameter	Thickneſs	Height	Thickneſs
	Inches	Inches	Inches	Inches
42-pounder	6.6	0.6	9.3	0.7
32 ditto	6.0	0.6½	8.3	0.8
24 ditto	5.4	0.6	7.3	0.9
18 ditto	4.9	0.6½	6.5	0.7
12 ditto	4.3	0.5	5.5½	0.6
9 ditto	3.9	0.4½	5.4	0.4
6 ditto	3.4	0.4½	4.4	0.4
4 ditto	2.9	0.4	4.1	0.3
3 ditto	2.4	0.5	3.6	0.3
1½ ditto	2.1	0.3	3.2	0.2
½ ditto	1.4	0.2	2.0	0.1½

TABLE *of experiments to find the beſt length of* GUNS, *and their* FITTEST CHARGES, *deduced from actual trials,* 1775.

Nature	Heavy		Mediums		Light		Powder	Elevation	Range
	Length	Weight	Length	Weight	Length	Weight			
Pdrs.	F. In.	C. q. lb.	F. In.	C. q. lb.	F. In.	C. q. lb.	lb. oz.	°	Yds.
42	9 6	61 2 10					21	6	2368
	10	62 1 18					14	6	2295
	10 6	62 2 25					14	6	2189
32	10	55 2 7					16	5 30	2043
	9 2	52 1 18					10 12	5	2103
	8	50 2 19					10 12	5 30	2118
24	11	51 0 5					12	5 30	2212
	9	39 1 3					8	5	2186
	9	39 1 3					8	5	2218
12	8	19 2 0					6	4 30	1780
	8	19 2 0					4	4	1637
	8	19 2 0					4	4	1652
24			8 5	40 2 0			12	5 30	1750
			8	40 1 0			8	5	1830
			8	40 1 0			8	5	1863
12					5 6	8 3 18	6	4 30	1203
					5	8 3 18	4	4	1189
					5	8 3 18	4	4	1216
6					4 6	4 3 14	3	5	1097
					4 6	4 3 14	2	5	1098
					4 6	4 3 14	2	5	1107
3					3 6	2 3 4	1 8	4 30	938
					3 6	2 3 4	1	4 30	943
					3 6	2 3 4	1	4 30	956

Theſe experiments were the reſult of the mediums of 8 rounds to each; from whence it appears, that when the pieces were loaded with half the weight of the ſhot, the ranges were greater than when loaded with either more or leſs, except in the ſmaller calibres, where 1-3d ſeems to be the beſt charge. Again, the pieces of 9 feet long, carried farther than thoſe of 10 feet 6 inches, and 11 feet, &c.

TABLE *of experiments with* GRAPE-SHOT *againſt a curtain* 39 *feet long, and* 8 *feet high, in* 1773.

Ordnance						Weight of				Greateſt effect at 200 yards		Greateſt effect at 300 yards	
Caliber	Length		Weight			Powder		Grape		Decimal parts of the char.	Weight of ſhot through	Decimal parts of the char.	Weight of ſhot through
	F.	in.	C.	q.	lb.	lb.	oz.	lb.	oz.				
H. 6-pound.	8	0	18	3	13	4	9	9	14	·31	3·4lb·	·33	3·3lb.
H. 6-pound.	8	0	18	3	13	3	2	5	8	·31	2.6	.22	1.2
H. 6-pound.	8	0	18	3	13	2	0	9	14	·33	2.7	.22	2.4
H. 6-pound.	8	0	18	3	13	2	0	5	8	·32	2·5	.29	1.6
L. 6-pound.	4	6	4	15	2	2	0	9	14	·34	3·4	.2	2·9
L. 6-pound.	4	6	4	15	2	1	8	5	8	·39	2.1	·38	2.0
L. 6-pound.	4	6	4	15	2	2	0	5	8	·38	2.6	·37	2.2
3-pounder	3	6	2	2	19	1	0	5	0	.42	2.0	·30	1·5
3-pounder	3	6	2	2	19	0	12	5	0	.62	1.8	·40	1.2
3-pounder	3	6	2	2	19	0	12	5	0	·58	1.6	·41	1·3
8-in. howit.	2	1½	11	3	0	3	0	38	4	·55	20.0	.27	10.0
8-in. howit.	2	1½	11	3	0	3	0	38	4	·57	18.7	.29	12.6
8-in. howit.	2	1½	11	3	0	3	0	38	4	·59	22 8	·36	11.8
5½-in. how.	1	6	4	0	0	1	0	13	8	·27	3·6	.22	3·0
5½-in. how.	1	6	4	0	0	1	0	13	8	·29	3 8	·23	3·5
5½-in. how.	1	6	4	0	0	1	0	13	8	·33	3·10	.22	3·7

In this table the 5 firſt columns are eaſily underſtood. By *greateſt effect* is meant the effect of the beſt round in 4, which was fired each at ¼ a degree elevation, beginning at 0 degree, and that effect (or number through the curtain) is expreſſed in decimal parts of the whole charge of grape. Hence .33 in the laſt column but one, means .33 hundredth parts of 9 lb. 14 oz. = 3.3 lb. nearly, and ſo of the reſt: ſo that, if ſuch experiments were ſufficiently purſued, theſe numbers would exhibit the comparative powers or fitneſs of each different kind of piece for grape-ſhot. N. B. *H.* means *heavy*, and *L.* *light* guns.

TABLE *of experiments with a light* braſs 6-pounder, *with* caſe-ſhot; *length* 4 *feet* 7 *inches, weight* 5 c. 0 qr. 18 lb. *with* 72 *ſhot, being ſingle proportion, and* 144, *double proportion in each caſe; weight of each ſhot* 1¼ *oz. againſt a target* 300, *and* 400 *yards diſtance. Weight of ſhot and bottoms* 6 *and* 12 lb.

Powder		Elevation		Length of charge from the muzzle		Recoil		Target				Total thro' and hit	Mediums thro' and hit	Shot ſpread from centre to				No. of ſhot in each caſe	Diſtance	Remarks
								Through		Hit				Right		Left				
lb.	oz.	D.	M.	F.	In.	F.	In.	un.	ov	un.	ov.	No.	No.	Yds.	F.	Yds.	F.	No.	Yards	
1	4	1	0	3	3	2	9	4	1	27	5	37	37	17	2	15	1	72	300	Single proportion. Short bottoms.
1	4	1	0	3	3	3	7	1	0	29	9	39	37	14	2	31	2			
1	4	1	0	3	3.5	3	8	3	1	23	7	34	37	22	2	17	0			
1	12	1	0	3	3.7	6	0	4	3	24	5	36	33	17	2	20	0			
1	12	1	0	3	3	6	6	7	6	19	3	35	33	15	0	30	0			
1	12	1	0	3	3	6	4	6	4	12	6	28	33	12	1	18	0			
1	4	1	0	2	10.5	5	4	4	3	30	13	50	69	12	1	32	0	144	300	Double proportion. Short bottoms.
1	4	1	0	2	10.5	6	2	12	12	53	12	89	69	16	2	29	2			
1	4	1	0	2	10.5	5	10	8	3	50	9	70	69	20	0	30	2			
1	12	1	0	2	9.3	12	5	19	13	35	9	76	73	13	2	27	0			
1	12	1	0	2	9.3	9	9	14	14	35	14	67	73	16	1	29	1			
1	12	1	0	2	9.3	11	3	18	9	36	12	75	73	16	1	25	1			
1	4	1	30	3	3.5	4	8	5	2	17	10	34	31	11	1	31	1	72	400	Single proportion. Short bottoms.
1	4	1	30	3	3.5	3	9	3	0	16	6	25	31	12	1	26	0			
1	4	1	30	3	3.5	4	10	6	4	16	7	33	31	15	0	20	1			
1	12	1	30	3	2	5	11	7	0	20	6	33	24	11	0	31	1			
1	12	1	3	3	2.7	5	5	2	2	13	3	20	24	16	1	19	0			
1	12	1	30	3	2.7	6	3	1	0	11	6	18	24	23	1	29	0			
1	4	1	30	2	10.5	5	5	0	0	8	3	11	18	9	1	31	1	144	400	Double proportion. Short bottoms.
1	4	1	30	2	10.7	6	0	2	1	14	8	25	18	19	0	32	0			
1	4	1	30	2	10.3	5	6	1	0	12	5	18	18	13	1	32	0			
1	12	1	30	2	9.5	8	7.5	5	1	14	4	24	19	23	2	31	0			
1	12	1	30	2	9.3	10	6.5	0	0	15	6	21	19	12	1	31	1			
1	12	1	30	2	9.5	9	9.5	0	0	10	3	13	19	18	1	31	0			

Table *of experiments with a medium* braſs 6-pounder, *with caſe-ſhot; length* 7 *feet* 2 *inches, weight* 10 c. 3qr. 0 lb. *with* 72, 144, *and* 216 *ſhot in each caſe, being ſingle, double, and triple proportions, weight of each ſhot* 1¼ *oz. againſt a target* 300, *and* 400 *yards diſtance; weight and bottoms* 6, 12, *and* 18 *lb.* Woolwich, 1777.

Powder		Elevation		Length of charge from the muzzle		Recoil		Target						Shot ſpread from centre to				Shot in each caſe	Diſtance	Remarks
								Through		Hit		Total through and hit	Mediums thro' and hit	Right		Left				
lb.	oz.	D.	M.	F.	In.	F.	In.	under	over	under	over	N°.	N°.	yds.	F.	yds.	F.	N°.	yards	
2	8	1	0	5	8	8	6	23	3	0	3	30	36	18	0	10	0	72	300	Single proportion. Short bottoms.
				5	8	9	6	10	6	10	5	31	36	15	0	15	0			
				5	8	9	3	21	2	10	5	38	36	15	0	21	0			
3	8			5	5	15	4	19	10	3	6	38	33	23	0	30	0			
				5	5	17	0	18	4	7	0	29	33	15	1	17	0			
				5	5	17	10	21	4	5	2	32	33	8	0	28	0			
2	8	1	0	5	3	16	0	12	7	22	7	48	56	22	1	21	0	144	300	Double proportion. Short bottoms.
				5	3	18	0	21	3	23	10	57	56	15	0	25	0			
				5	3	18	0	21	8	22	10	61	56	23	2	22	0			
3	8			5	1	26	0	23	4	25	7	59	59	21		20	0			
				5	1	27	6	28	12	15	3	58	59	13	1	22	0			
				5	1	27	0	22	6	19	12	59	59	16	1	22	0			
2	8	1	0	4	10	24	0	28	8	31	10	77	75	24	0	30	0	216	300	Triple proportion. Short bottoms.
				4	10	21	6	17	10	33	11	71	75	26	1	19	0			
				4	10	21	6	23	10	28	12	73	75	21	1	22	0			
3	8			4	8	28	6	19	10	29	18	76	74	24	1	25	0			
				4	8	28	6	34	9	28	12	88	74	23	0	20	0			
				4	8	29	0	29	13	20	11	73	74	19	0	26	0			
2	8	1	30	5	8	7	6	2	1	22	9	34	37	18	1	28	0	72	400	Single proportion. Short bottoms.
				5	8	8	9	14	3	14	7	38	37	15	2	10	0			
				5	8	9	1	11	4	18	5	38	37	17	0	28	0			
3	8			5	5	12	8	8	5	12	1	26	28	21	1	13	0			
				5	5	12	7	13	6	15	3	37	28	13	0	23	0			
				5	5	12	3	6	7	6	3	22	28	23	0	30	2			
2	8	1	30	5	3	6	6	2	3	20	15	40	45	20	1	22	1	144	400	Double proportion. Short bottoms.
				5	3	6	8	4	5	26	19	46	45	26	1	21	1			
				5	3	6	7	6	3	27	11	47	45	21	1	21	0			
3	8			5	1	26	0	4	2	35	8	49	53	23	0	24	0			
				5	1	28	0	11	7	25	7	50	53	27	0	22	0			
				5	1	36	0	11	5	35	7	58	53	21	1	27	2			
2	8	1	30	4	8	12	7	12	4	36	6	58	66	25	1	20	0	216	400	Triple proportion. Short bottoms.
				4	8	12	7	3	1	47	16	67	66	20	0	31	2			
				4	8	13	6	14	3	43	14	74	66	23	1	22	0			
3	8			4	7	36	0	7	0	19	5	31	49	18	1	29	1			
				4	7	40	0	7	5	21	6	39	49	16	0	23	1			
				4	7	36	0	14	3	41	11	69	49	24	0	28	1			

TABLE *of experiments with a* heavy braſs 12-pounder, *with caſe-ſhot; length* 9 *feet; weight* 31 c. 1qr. 16 lb. *with* 84 *ſhot in each caſe; weight of each ſhot* 2 *oz. againſt a target* 400 *yards diſtance. Weight of ſhot and bottom* 12 *lb.* 1778.

Powder		Elevation		Length of charge from the muzzle		Recoil		Target						Shot ſpread from the centre to				Shot in each caſe	Diſtance	Remarks
								Through		Hit		Total through and hit	Mediums thro' and hit	Right		Left				
lb.	oz.	D.	M	F.	In.	F.	In.	under	over	under	over	No.	No.	yds.	F.	yds.	F.	No.	yards	
6	0	2	0	6	9.6	4	6	11	8	4	2	25	25	24	0	24	1	84	400	Common bottoms.
				6	9 6	5	0	13	9	4	2	28	25	24	0	22	0			
				6	9.6	5	0	11	5	6	4	26	25	17	0	15	0			
				6	10.2	5	0	12	5	4	3	24	25	10	0	18	2			
				6	10.1	4	6	9	4	8	2	23	25	25	0	17	1			
				6	10.1	4	6	15	5	4	0	24	25	16	2	11	1			
		2	15	6	11	6	0	17	4	4	0	25	27	16	0	27	1	84	400	Short bottoms.
				6	11	5	0	13	6	9	0	28	27	17	2	9	0			
				6	10.6	5	6	22	5	3	2	32	27	17	2	19	1			
				6	11	5	0	17	1	8	3	29	27	23	1	20	1			
				6	10.5	5	6	16	2	5	0	23	27	24	2	7	0			
				6	11	5	6	11	8	4	1	24	27	12	2	14	2			
6	8	2	0	6	10	8	1	22	7	10	3	42	32	19	0	25	0	84	400	No bottoms.
				6	9	8	2	17	4	8	4	33	32	21	2	21	0			
				6	10	8	4	16	6	11	0	33	32	27	1	16	0			
				6	9	8	0	13	6	4	3	26	32	16	2	7	2			
				6	9	8	6	11	6	5	0	22	32	20	1	25	0			
				6	9	8	5	23	3	6	2	34	32	21	1	23	1			
		2	15	6	11	8	9	24	9	3	3	39	33	18	2	19	0	84	400	Common bottoms.
				6	9	8	7	17	9	4	2	32	33	21	0	26	2			
				6	10	8	4	11	14	3	0	28	33	22	1	14	2			
				6	10	8	8	17	8	4	2	31	33	23	1	11	1			
				6	10	8	3	17	9	4	3	33	33	23	2	14	1			
				6	11	8	4	16	5	5	3	29	33	20	1	12	1			
7	0	2	0	7	0	10	8	14	7	5	5	31	34	14	2	19	0	84	350	Short bottoms.
				7	1	11	0	13	11	7	1	32	34	22	2	19	2			
				7	0	10	8	16	5	2	0	23	34	3	1	12	0			
				7	0	10	8	20	14	3	4	41	34	28	0	19	0			
				7	1	11	3	17	8	7	2	34	34	24	1	19	1			
				7	1	11	2	20	8	10	2	40	34	20	0	21	1			
		2	30	6	9.4	11	3	13	7	6	0	26	27	8	0	25	0	84	350	No bottoms.
				6	10.5	11	3	16	2	3	1	22	27	24	0	17	0			
				6	9.5	11	5	14	10	1	0	25	27	24	2	17	0			
				6	9	11	4	14	13	2	1	30	27	12	1	16	0			
				6	9.5	11	4	17	6	6	1	30	27	20	2	12	1			
				6	9.7	11	5	16	10	1	2	29	27	16	0	19	0			

Table *containing the greateſt ranges of the ſeveral* Howitzers, *with different charges and elevations, deduced from actual experiments.*

Elevation		Calibre 8 in. ſhell 42lb. chamb. holds 3lb. 8oz. ſhell 2¼lb. Greateſt range 1800 yards.			Royal 5.8 ſhell 15lb. chamber holds 1lb. ſhell 14oz. Greateſt range 1600 yards.			Coehorn 5.5 ſhell 8lb. cha. holds 8oz. ſhell 7oz. Greateſt range 900 yards.			Time of flight.	Length of fuze.	Greateſt range with the given charge.
Deg.	Min.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	ſeconds	inches	yards
7	30	0	4	12	0	2	4	0	1	8	1.46	0.18	120
8	0	0	5	8	0	2	7	0	1	11	1.49	0.21	128
8	30	0	6	4	0	2	10	0	1	14	1.62	0.30	136
9	0	0	7	0	0	2	13	0	2	0	1.78	0.32	150
9	30	0	7	12	0	3	0	0	2	4	1.83	0.46	180
10	0	0	8	8	0	3	4	0	2	7	2.10	0.70	216
10	30	0	9	4	0	3	8	0	2	10	2.79	0.72	248
11	0	0	10	0	0	3	12	0	2	13	3.10	0.89	306
12	0	0	10	12	0	4	0	0	3	0	3.19	0.98	343
13	0	0	11	8	0	4	4	0	3	6	3.68	1.08	382
14	0	0	12	4	0	4	8	0	3	12	4.10	1.22	418
15	0	0	13	0	0	4	12	0	4	0	4.75	1.26	480
8	0	0	13	12	0	5	0	0	4	8	3.04	0.88	210
9	0	0	14	8	0	5	4	0	5	0	3.19	0.94	328
10	0	0	15	4	0	5	9	0	5	8	3.58	0.93	360
11	0	1	0	0	0	5	13	0	6	0	3.74.	1.04	389
12	0	1	4	0	0	6	1	0	6	8	4.60	1.18	467
13	0	1	8	0	0	6	7	0	7	0	5.12	1.46	648
14	0	1	12	0	0	6	12	0	7	8	6.54	1.49	792
15	0	2	0	0	0	7	1	0	8	0	7.12	2.48	900
8	0	2	4	0	0	7	10				7.10	3.33	962
10	0	2	8	0	0	8	0				.13	3.68	1136
12	0	2	12	0	0	10	0				9.21	3.80	1242
14	0	3	0	0	0	12	0				9.60	3.92	1308
15	0	3	4	0	1	0	0				10.10	4.32	1600
16	0	3	8	0							11.48	4.62	1800

This **Table** will be of great ſervice to the young officer, who has not a collection of experiments, nor ſeen much practice.

TABLE *of practice, with the following braſs ordnance.* Woolwich, 1777.

Ordnance						Powder		Elevation		Recoil		Target's diſtance	Shot went to								Remarks
Nature	Length		Weight										Right		Left		Under		Over		
Pounders	F.	In.	C.	q.	lb.	lb.	oz.	D.	M.	F.	In.	yards	F.	In.	F.	In.	F.	In.	F.	In.	
Heavy 12	9	0	29	3	3	6	0	0	30	12	0	530	2	0					3	0	Through the target
								0	40	10	0		5	0			0	6			
								0	40	11	0				6	0			2	0	
								0	50	10	8		1	6			1	3			
Medium 12	6	6	21	1	11	4	8	0	30	9	0	400	2	0			7	0			
								1	0	11	6				8	0	8	0			
								1	0	9	0				5	0	2	0			Near the target
								0	30	11	3				6	3	0	8			
Light 6	4	6	5	0	26	1	8	0	15	13	0	300			0	6			3	0	
								0	0	15	0		0	6					0	6	
								0	15	19	0				1	6					
								0	30	16	7		1	4							Through the target
Heavy 12	9	0	29	3	3	6	0	0	30	8	0	530	6	0					2	0	
								0	30	10	0				9	0	4	6			
								0	35	9	4		7	0			6	0			
								0	35	8	7		3	4			3	5			Through the target
Medium 12	6	6	21	1	14	4	8	0	30	7	0	400	2	6					1	6	
								0	30	8	4		2	0					6	6	
								0	35	7	6		1	0			6	6			
								0	35	7	9										Through the target
Light 6	4	6	5	0	26	1	8	0	15	8	6	300	6	0					2	6	
								0	15	8	4		1	6					2	0	Through the target
								0	15	8	3		2	6			1	6			
								0	15	8	4		1	5			3	6			
Medium 12	6	6	21	1	14	4	8	0	15	12	0	400	7	0			3	0			
								0	15	13	6				1	0			2	6	Through the target
								0	15	13	0				2	6			1	4	
								0	15	13	6		3	6					3	8	
Light 6	4	6	5	0	26	1	8	0	30	14	0	300			0	6			0	6	
								0	30	13	0				4	0					Through the target
								0	15	13	0		4	0			4	0			
								0	15	13	6		3	6			3	6			
Heavy 12	9	0	29	3	3	6	0	1	0	10	0	400	2	0	6	0			4	0	
								1	0	10	6										Through the target
								1	0	10	6		4	0			2	6			Ditto
								1	0	10	4				1	0	2	6			Ditto

N. B. The firſt 12 rounds the ſhot were fixed to wooden bottoms; the ſecond 12 rounds the ſhot were not fixed to wooden bottoms. All the reſt had wooden bottoms.

TABLE, *containing the greateſt ranges of the ſeveral* land mortars *with different charges, deduced from actual experiments.* 1773.

CALIBRE 13 inches, ſhell 205lb. chamb. holds 8 lb. ſhell 9lb. Greateſt range 2500 yards.			CALIBRE 10 inches, ſhell 94 lb. chamb. holds 5¼lb. ſhell 3¼lb. Greateſt range 3000 yards.			CALIBRE 8 inches, ſhell 42 lb. chamb. holds 2lb. ſhell 2¼lb. Greateſt range 1800 yards.			ROYAL. Calibre 5⅔ inches, ſhell 15 lb. cha. 9 oz. ſhell 14 oz. Greateſt range 1500 yards.			COEHORN. Calibre 4⅔lb. ſhell 8 lb. cha. 4½oz. ſhell 7 oz. Greateſt range 900 yards.			Time of flight	Length of fuze.	Greateſt range with the given charge	Square roots of the greateſt range.
lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	lb.	oz.	dr.	Sec.	inch.	yds.	yards.
0	7	0	0	5	8	0	4	12	0	2	4	0	1	8	4.37	10.9	100	10
0	10	0	0	7	0	0	5	8	0	2	7	0	1	11	5.28	1.32	150	12.25
0	13	0	0	8	8	0	6	4	0	2	10	0	1	14	6.20	1.55	200	14.14
1	0	0	0	10	0	0	7	0	0	2	13	0	2	1	6.80	1.70	250	15.81
1	3	0	0	11	7	0	7	12	0	3	0	0	2	4	7.50	1.88	300	17.32
1	6	0	0	12	14	0	8	8	0	3	4	0	2	7	8.12	2.03	350	18.71
1	9	0	0	14	5	0	9	4	0	3	8	0	2	10	9.68	2.15	400	20
1	12	0	0	15	12	0	10	0	0	3	12	0	2	13	10.12	2.28	450	21.21
1	14	8	1	1	3	0	10	12	0	4	0	0	3	0	10.60	2.42	500	22.36
2	1	0	1	2	10	0	11	8	0	4	4	0	3	3	11.00	2.53	550	23.45
2	3	8	1	4	1	0	12	4	0	4	8	0	3	6	11.40	2.65	600	24.5
2	6	0	1	5	8	0	13	0	0	4	12	0	3	9	11.84	2.75	650	25.5
2	8	8	1	6	15	0	13	12	0	5	0	0	3	12	12.20	2.85	700	26.46
2	10	10	1	8	6	0	14	8	0	5	4	0	3	15	12.64	2.96	750	27.29
2	12	12	1	9	13	0	15	4	0	5	9	0	4	2	13.00	3.05	800	28.29
2	14	14	1	11	4	1	0	0	0	5	13	0	4	5	13.32	3.16	850	29.16
3	0	0	1	12	11	1	0	12	0	6	1	0	4	8	13.72	3.25	900	30
3	2	2	1	14	2	1	1	8	0	6	7				14.00	3.33	950	30.82
3	6	0	1	15	9	1	2	4	0	6	12				14.40	3.43	1000	31.63
3	8	8	2	1	0	1	3	0	0	7	1				14.72	3.50	1050	32.40
3	11	0	2	2	7	1	3	12	0	7	6				15.00	3.60	1100	33.16
3	13	8	2	3	14	1	4	8	0	7	11				15.28	3.68	1150	33.92
4	0	0	2	5	5	1	5	4	0	8	0				15.60	3.75	1200	34.64
4	2	8	2	6	12	1	6	0	0	8	4				15.84	3.82	1250	35.35
4	5	0	2	8	1	1	6	12	0	8	9				16.12	3.90	1300	36
4	7	8	2	9	8	1	7	8	0	8	13				16.48	3.96	1350	36.74
4	10	0	2	10	15	1	8	4	0	9	0				16.72	4.03	1400	37 42
4	12	8	2	12	6	1	9	0							17.00	4.12	1450	38.08
4	15	0	2	13	13	1	9	12							17.28	4.18	1500	38.73
5	1	8	2	15	4	1	10	10							17.56	4.25	1550	39.37
5	4	0	3	0	11	1	11	8							17.80	4.32	1600	40
5	6	8	3	2	2	1	12	11							18.12	4.39	1650	40.62
5	9	0	3	3	9	1	13	10							18.48	4.45	1700	41.23
5	11	8	3	5	0	1	14	10							18.59	4.53	1750	41.83
5	14	0	3	6	7	2	0	0							18.72	4.62	1800	42.43
6	12	0	3	9	5										19.03	4.75	1900	43.59

Table *of the greateſt ranges of* ſea-mortars, *with different charges, deduced from actual experiments.*

13 inch. chamber holds 30lb.	Flight in ſeconds	Fuze in inches	Range in yards	10 inches. Chamber holds 12lb.	Flight in ſeconds	Fuze in inches	Range in yards
10	15	5.18	3127	4	22½	4.83	2550
15	19½	5.83	3206	6	23	4.95	2650
20	25	6.25	3300	8	23½	5.75	2800
25	26½	6.74	3413	9	24¼	5.94	3000
28	27½	7.03	3796	10	25	6.13	3200
30	29	7.25	4000	11	25½	6.25	3350
30	29½	7.25	4013	12	26	6.44	3500

Though theſe two laſt *tables* of all the different kinds of mortar-practice, deduced from actual experiments, are not ſtrictly to be depended on by the practitioner, who has time and opportunity to make a ſet of experiments with the very piece he is uſing, (for thoſe are preferable to any others); nevertheleſs, theſe two *tables* will be of ſingular uſe to a young officer who enters on actual ſervice, without having ſeen much practice.

TILE, } TYLE, } in *military building*, a ſort of thin, factitious, luminated brick, uſed on the roofs of houſes; or more properly a kind of clayey earth, kneaded and moulded of a juſt thickneſs, dried and burnt in a kiln, like a brick, and uſed in the covering and paving of different kinds of military and other buildings. The beſt of brick earth ſhould only be made into *tiles*.

The *tiles* for all ſorts of uſes may now be compriſed under 7 heads, viz. 1. The *plain tile*, for covering of houſes, which is flat and thin. 2. The *plain tile*, for paving, which is alſo flat, but thicker; and its ſize 9, 10, or 12 inches. 3. The *pan-tile*, which is alſo uſed for covering of buildings, and is hollow, and crooked, or bent, ſomewhat in the manner of an S. 4. The *Dutch glazed pan-tile*. 5. The *Engliſh glazed pan-tile*. 6. The *gutter-tile*, which is made with a kind of wings. And 7. The *hip* or *corner-tile*.

Plain Tiles, are beſt when they are firmeſt, ſoundeſt, and ſtrongeſt. Some are duſkier, and others ruddier, in colour. The duſky-coloured are generally the ſtrongeſt. Theſe *tiles* are not laid in mortar, but pointed only in the inſide.

Paving-Tiles, are made of a more ſandy earth than the common or *plain-tiles*: the materials for theſe laſt muſt be abſolute clay, but for the others a kind of loam is uſed. Theſe are made thicker and larger than the common *roof-tiles*; and, when care has been taken in the choice of the earth, and the management of the fire, they are very regular and beautiful.

Pan-Tiles, when of the beſt kind, are made of an earth not much unlike that of the *paving tiles*, and often of the ſame; but the beſt ſort of all is a pale-coloured loam that is leſs ſandy; they have about the ſame degree of fire given them in the baking, and they come out nearly of the ſame colour. Theſe *tiles* are laid in mortar, becauſe the roof being very flat, and many of them warped in the burning, will not cover the building ſo well, as that no water can paſs between them.

Dutch glazed Pan-Tiles, get the addition of glazing in the fire. Many kinds of earthy matter running into a glaſſy ſubſtance in great heat, is a great advantage to them, preſerving them much longer than the common *pan-tiles*, ſo that they are very well worth the additional charge that attends the uſing of them.

Engliſh glazed Pan-Tiles, are in general not ſo good as the Dutch ones under that denomination; but the proceſs is nearly the ſame.

Dutch Tiles, for chimnies, are of a kind very different from all the reſt. They are made of a whitiſh earth, glazed and painted with various figures, ſuch as birds, flowers, or landſcapes, in blue or purple colour; and ſometimes quite white: they are about 6.5 inches each way, and three quarters of an inch thick. They are at preſent grown into neglect.

Gutter-Tiles, are made of the ſame earth as the common *pan-tiles*, and only differ from them in ſhape; but it is adviſable, that particular care be taken in tempering and working the earth for theſe, for none are more liable to accidents. The edges of theſe *tiles* are turned up at the larger ends for about 4 inches. They are ſeldom uſed where lead is to be had.

Hip or *Corner*-Tiles, are at firſt made flat like *pan-tiles* of a quadrangular figure, whoſe two ſides are right lines, and the ends arches of circles; the upper end concave, and the lower convex; the latter being about 7 times as broad as the other: they are about 10.5 inches long; but, before they are burnt, are bent upon a mould in the form of a *ridge-tile*, having a hole at the narrow end, to nail them on the hip-corner of the roof.

Ridge-Tiles, are uſed to cover the ridges of houſes, and are made in the form of a ſemi-cylindrical ſurface, about 13 inches in length, and of the ſame thickneſs as *plain-tiles*: their breadth at the outſide meaſures about 16 inches.

W

WADDING. See this word in the firſt Alphabet.

Experiments relative to the effects of WADDING.

The quantity of powder requiſite to raiſe a ſhell, weighing 218 lb. clear of the mortar and bed, was found to be 4 oz. 2 dr. without any *wadding*; but with the help of a little *wadding*, rammed over the powder, 3 oz. and 1 dr. was ſufficient. The powder requiſite to raiſe a ſhell weighing 106 lb. clear of the mortar and bed, was found to be 2 oz. 6 dr. without any *wadding*; but with *wadding*, properly rammed over the powder, 2 oz. was found to be ſufficient.

To raiſe a ſhell of 16 lb. 4 dr. was ſufficient without *wadding*, and only 3 dr. with *wadding*.

And to raiſe a ſhell of 8 lb. 2 dr. was enough without *wadding*, and $1\frac{2}{3}$ dr. with *wadding*.

From the above experiments it may be obſerved, that the judicious ramming a little *wadding* over the powder, adds about 1-4th part of the whole effect.

THE END.

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The eggs of all, with the neſts of the ſmall, not omitting thoſe of ſnakes, lizards, and tortoiſes, ſea-eggs, urchins, and ſtars.

Plants. Take that part of either tree or herb, with flower, ſeed, or fruit on them; but if none, gather them; and if the leaves by the root differ from thoſe above, take both; put them into a book, or quire of brown paper (which you take with you) ſo ſoon as gathered, and once a week ſhift them to a freſh place, to prevent rotting them or the paper.

Plants, ſeeds, and dry fruits, as nuts, pods, heads, huſks, &c. with their leaves, flowers, and fruit, if poſſible, dried and wrapped in paper; alſo a piece of the wood, bark, root, gum, or roſin, of any tree or herb that is remarkable for beauty, ſmell, uſe, or virtue.

Inſects, as beetles, ſpiders, graſhoppers, flies, waſps, fire-flies, &c. may be drowned as caught, in a wide-mouth'd glaſs or phial of the ſaid ſpirits or pickle, which you may carry in your pocket. Butterflies or moths, or night butterflies, having mealy wings, which may be rubbed off with the fingers, ſhould be pinned when caught, and give the body a pinch to put it out of pain.

The beſt method to preſerve their beauty is to pin them in a chip or cork-bottomed box, covering them with tobacco-duſt, ſnuff, or beat white pepper, to ſave them from devouring inſects.

Sea-ſhells are very acceptable, yet the land and freſh water are the moſt rare. Get them alive and keep them whole.

Shells, &c. not otherwiſe to be had, are to be found in the ſtomachs of various large fiſh, and ſometimes in ſmall, as ſoles, &c. and on the backs of whales, &c.

Oyſters, cockles, ſcollops, &c. viz. bivalves, or ſhells in pairs, ſhould be preſerved with their original ligaments or fixtures.

Sea and water ſhells of the trochi, wilk, ſnail, volute, or buccina, &c. ſpecies, have an operculum or door (without which they are not complete): theſe they ſhut, when at reſt, to defend. The few without, adhere to the rocks or ground for defence.

Clear the large of their fiſh without boiling, if poſſible; the ſmall may be kept with their operculum, and fiſh in them, without offence, in bran, ſand, &c. to dry.

Boiling oft hurts and even changes the colour; as lobſters, crabs, &c. Corals, and all ſea-plants, weeds, &c. are beautiful.

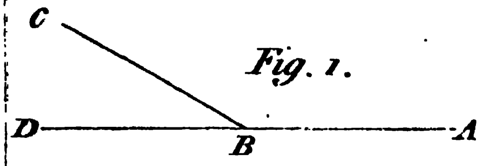
Never let your ſhells, corals, &c. be touched with any corroding acids, ſuch as ſpirit of ſalt, aqua-fortis, vinegar, &c. which will entirely deſtroy or exhauſt them.

Small } Specimens } Large } Animals and Shells
Large } of the } Small } are moſt eſteemed,
when the different ſizes cannot be had.

All coloured ſtones, earths, clays, minerals, metals and ores, to be taken as you find them; ſtones having any reſemblance to ſhells, fruits, wood, bones, &c. to be got as intire as you can; and ſlates that have the impreſſion of plants, fiſhes, or other bodies in or upon them; found in quarries, mines, pits, caves, or wherever the earth is opened.

N. B. Amongſt plants, the moſt common graſs, ruſh, fern, thiſtles, thorns, or vileſt weeds you can find abroad, may meet with the ſame acceptance as ſcarce plants; ſo in all other things the moſt common, as well as rare, i. e. whatever you meet with, may prove acceptable preſents, and have gained preferment where money could not avail.

Pl. I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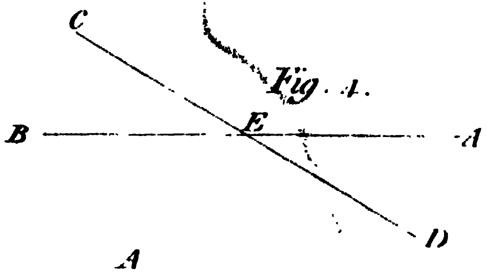
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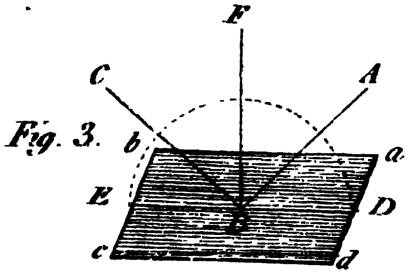
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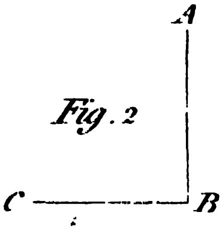
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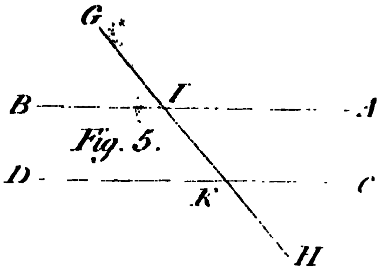
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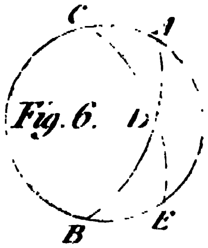
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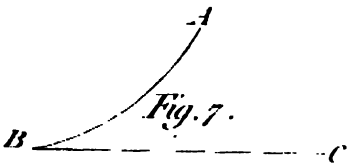
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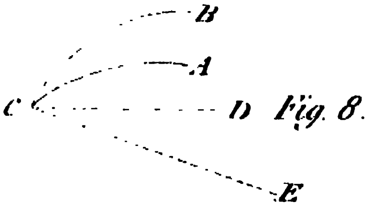
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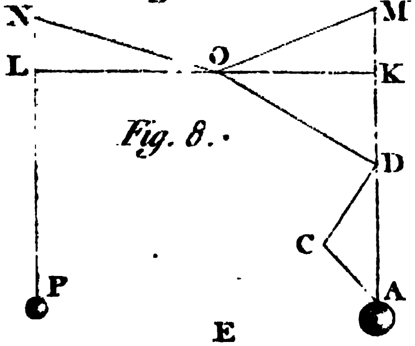
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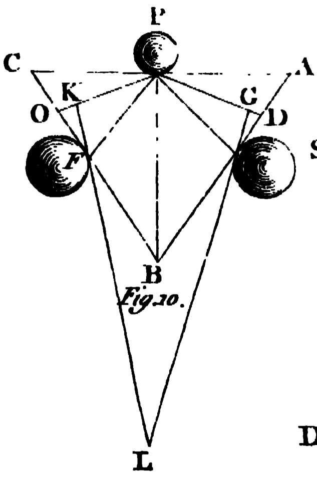
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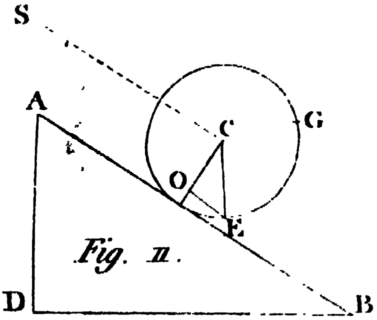
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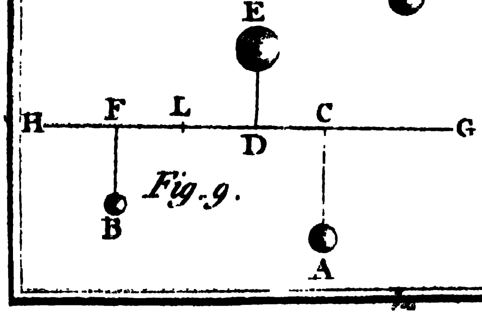
Fig. 9.